ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 27. No. 9. WEEKLY. | NEW YORK, WEDNESDAY, AUGUST 28, 1895. | $3 per Annum. Single Copies, 10 Cents.

Copyright, 1895, by Electrical Review Publishing Company, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

The idea of hatching eggs by electricity may appear somewhat farfetched, but electric incubation is not only being carried on in Germany but is growing up into a large industry, says London *Lightning*. A Strasburg electrician, who has been experimenting for three years, has found that with the electrical incubator 90 chickens can ordinarily be counted on out of every 100 eggs dealt with.

Einer Rasmussen, from Christiania, Norway, in the employ of the Norwegian Government, who is investigating the subject of electric power produced from water power, was in Concord, N. H., last week, and visited the plant of the Concord Land and Water Power Company and expressed himself as much pleased with it. He has visited all the larger water powers of the country and is now returning home.

Professor Austen, of the Royal British Mint, has recently made some electrolytic experiments showing that glass is porous to molecules below a certain weight and volume. A current was passed through a vessel containing an amalgam of sodium, separated by a glass partition from mercury. After awhile the amalgam was found to have lost a certain amount of its weight, while the same amount had been added to the mercury. The same result was obtained with an amalgam of lithium; but with potassium, whose atomic weight and volume are high, the glass could not be penetrated.

Dr. D'Arsonval, in recent experiments on the electric ray or torpedo fish, connected a 10 candle-power incandescent lamp with the electric organ of the fish, and on irritating the skin the lamp was lighted. He finds that in a fish of medium size, 12 to 15 inches in diameter, the current amounts to two to seven amperes, with an electro-motive force of eight to 17 volts. The electric organ acts like a muscle, giving out electric instead of mechanical energy. The discharge is alternating, consisting of a series of partial, diminishing discharges that follow one another at intervals of one-hundredth of a second. The back of the torpedo acts as the positive pole and the belly the negative pole of the electric generator. The organ emits a sound during the discharge, and when the circuit is closed becomes heated.

Electricity escaped from electric light wires one night recently and charged all the metal work in the buildings Nos. 154, 156, 158 and 160 Springfield avenue, Newark, N. J. Max Muller, a saloon-keeper, at No. 154, was shocked a dozen times while working about his bar, and was knocked down when he grasped a brass faucet. He went into his cellar and found the woodwork afire. Seizing a gallon copper measure filled with water he dashed its contents on the flame, receiving a shock through the water which dazed and staggered him. Then he summoned the fire department, but the firemen refused to go to work until the electric light company shut off its current.

An injunction against the Brunswick, N. J., electric railway company was granted by Vice-Chancellor Pitney on August 20 restraining the company from building trolley roads in Middlesex County. The application was made by Attorney-General Stockton on the ground that the roads were too narrow for trolley lines.

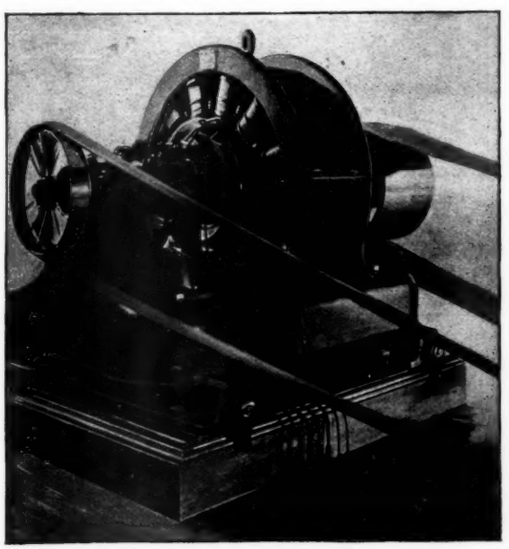


Fig. 1.—Three-Phase Generator for Long-Distance Transmission at Silverton, Colo.

A curious state of affairs is presented by the Massachusetts Gas and Electric Light Commission ordering the electric light company at Woonsocket, R. I., a Rhode Island corporation, to furnish lights to the town of Blackstone at 42 cents a light instead of 50, the price under the old contract. The electric light company will refuse, and the matter will probably be settled in the Massachusetts courts.

Three-Phase Long-Distance Transmission for Mining Work.

An important application of the three-phase system of long-distance transmission of power has recently been installed and put in operation at the Silver Lake mines, near Silverton, Colo., where power is transmitted a distance of three miles through some of the roughest country in Colorado. It is attracting considerable attention among mining men, as it is the first three-phase plant installed in the Rocky Mountain region.

The success of direct-current transmission has been thoroughly demonstrated by transmission plants operating not only in California but elsewhere all over the world. The expense, however, inseparable from direct-current transmission, precludes the utilization of that system in most places where the distance exceeds a certain limited number of feet. This will be readily understood when it is stated that if 100 horse-power can be transmitted by direct current one mile at 500 volts, 10 per cent being allowed for loss in the line, the copper wire necessary will cost about $2,000, while for the same horse-power transmitted by the same system for 10 miles it will cost about $200,000. If, however, the three-phase current at 5,000 volts be employed to transmit the 100 horse-power 10 miles, the cost will not be more than $2,000. In other words, a given horse-power can be transmitted by the three-phase system at 5,000 volts 10 times farther than a similar horse-power by the direct-current system at 500 volts for the same expenditure in copper. As, therefore, the question of dollars and cents is a most prominent factor in all transmission installations, the three-phase system, where long-distance transmission is concerned, is the most practical system because the most economical, commercially speaking, and the installation at Silverton is a striking example of this fact.

The Silver Lake group of mines lies about four miles southeast of Silverton and is situated at an altitude of 12,300 feet above sea level. They are owned by Edward G.

Stoiber. The ore mined carries both gold and silver, is of a comparatively low grade and requires concentration.

Previous to the installation of electricity the mill, which is situated on the shores of the lake near the mouth of the mine tunnel, was run by steam. Coal was brought to the steam engine by the zigzag path up the mountain, shown in Fig. 3, and by the time it reached the furnace, cost $8.75 a ton. This represented a monthly expenditure of almost $1,000, and the expense proved a burden which went far to eat up the profits of the mine. Reform, therefore, became imperative.

The plant is now operated by water-power, which is brought from the Animas River, above Silverton, through a three by four-foot flume 9,750 feet in length, which carries 2,350 cubic feet of water per minute. Flume and trestle are shown in Figs. 2 and 4. One of the great advantages of electrical utilization is here demonstrated, for it was found less expensive to build this costly two-mile flume, running from above Silverton down to a spot where the necessary head could be utilized, and then to transmit the electricity back to the mine, rather than to continue to burn coal at the price which it brought at the mouth of the Silver Lake mines.

The head of water obtained is about 180 feet; this develops on the water-wheel shaft 640 horse-power. The plant consists of two four-foot double-nozzle Pelton water-wheels with special buckets belt-connected to two 150-kilowatt (200 horse-power) General Electric three-phase generators.

The current from these machines is given out at 2,500 volts and is transmitted over a distance of a little more than three miles to the Silver Lake mill and mine.

The conductors are No. 3 Brown & Sharpe bare copper wires, one for each branch of the three-phase circuits. These are strung from the power house, shown in Fig. 2, up the mountain passes and through the rugged forbidding country shown in the illustrations. In one place where a chasm has to be spanned the wires leap from pole to pole, a distance of 275 feet. They have been strung with especial care as befitted the abnormal conditions. At each insulator the wire is run through a short piece of rubber tube as an extra precaution against leakage. Lightning arresters are placed at each end of the line and an additional safe guard against possible damage by lightning is provided in the shape of a barbed iron wire which extends the entire distance of the line along the tops of the poles and is grounded at every second pole. In this country, where the storms are frequent and the lightning disastrous in its effects, every precaution is taken to frustrate possible damage from atmospheric discharges. The most effective lightning arresters which have been found for this work are claimed to be those which the General Electric Company itself manufactures, although many other kinds have been tried.

In the Winter time the snow lies thickly on the ground and all intercourse between the mine and civilization is almost cut off. Some idea of the difficulties of the road may be gathered by referring to Fig. 3, where the zig-zag route up the side of the mountain is shown.

Arriving at the mine the current is supplied to a 100 horse-power three-phase induction motor run directly from the primary circuit. Another 100 horse-power motor, as well as one of 75 horse-power, are located beneath the ground, and current is supplied to these at a pressure of 220 volts, the reduction in pressure being effected by step-down transformers. In addition, a 15 horse-power motor runs a pump, raising water from the lake to the mill, and one small one horse-power motor operates a blower and the lights for a bank, office and other buildings, both being connected to the secondaries.

Fig. 2.—Power House at the End of the Flume, Silverton, Colo.

The induction motor used is an excellent representation of the latest type of alternating current motor built by the General Electric Company. There are no commutators, collector rings or brushes. The field winding is connected to the circuit, but there is no connection between the armature and any external source of current. The three-phase currents rising and falling in the field windings induce corresponding currents in the armature winding and the armature revolves. The field armature cores are so completely laminated that all loss from eddy currents is practically eliminated. The speed of the motor is at all loads practically constant. The starting resistance for preventing any excessive current in the armature winding while gaining speed is contained in the armature itself and the handle shown in the cut serves to cut out the resistance when the motor is fully up to speed. These induction motors are built to stand the severest conditions met with in actual service, and wherever they have been employed have answered every requirement possible.

The interest in this mine centers, of course, upon the economy induced by the electrical installation. The power used in the mill and the mines at the present time is more than three times as much as was used when generated by the steam engine previously employed. If, therefore, $1,000 a month or $12,000 per year would be economized by using the same power, an economy of not less than $36,000 a year is effected by the operation of the mine by electricity and a greater power is available. This has allowed of the operation of machinery inside the mine for the first time.

Before such figures as these any question as to the economy of an electrical installation, when coal is anywhere near the price it is in this case, becomes irrational.

Electric and Steam Road Competition in Maryland.

The Pikesville, Reisterstown & Emory Grove Electric Railroad was formally opened to traffic on May 20, says the *Railroad Gazette*. This line is an extension of the Pimlico and Pikesville electric road, except that it is owned and operated by a separate company, and it is a part of the proposed trolley railroad between Baltimore and Gettysburg. It was built for the accommodation of the people who spend the Summer at the camp grounds in Glyndon and Emory Grove, as well as the crowds who flock thither on Sundays and special occasions. By means of this extension a new route is opened up for local travel about 20 miles in length, and that part of the line above Pikesville is the first long-distance electric railroad to be equipped in Maryland wholly outside of Baltimore.

At present passengers from any part of the city are carried on the Traction company's lines to Retreat street, where they transfer to the Pimlico and Pikesville railroad. Thence they are carried seven and one-half miles to Pikesville where a second transfer is made to the cars of the "Emory Grove Road," the latter being 11 miles long. The Pimlico and Pikesville railroad was originally a horse car line, extending from the old city boundary to the racing grounds at Pimlico, with a branch running up to Pikesville. This line, which never paid expenses, was acquired by the Traction company in 1891, and was immediately fitted out electrically, going into operation July 25, 1892. In 1890 the pool rooms in Baltimore were closed by law, and others were opened at Pimlico and West Arlington. This provided a large volume of passenger traffic to these points, and the new electric railroad became popular. The accommodations to Pimlico created a call for similar privileges to Arlington, and in 1893 the Traction company built a branch road from Pimlico to that point. This road accommodates the patrons of the racing track as well as a large and increasing population living in that handsome suburban town.

In 1891 some of the stockholders of the Emory Grove camp ground conceived the idea of building an electric railway from Baltimore to the "Grove." The Western Maryland Railroad was the only means of communication with the city, except the old Pikesville and Reisterstown turnpike for carriage driving. Several meetings were held and the project assumed a practical form in the organization of a company, with Mr. George R. Webb at its head. Stock was subscribed and contracts let for equipping the line in August, 1894. The line is a single-track trolley railroad with several switches and sidings providing for the meeting and passing of cars. The rolling stock consists of five open Summer cars and five closed cars of the Brill and Westinghouse pattern.

A company was also organized in Westminster last November to continue this electric railroad from Reisterstown to Union Mills, a distance of 17 miles, but this scheme has been blocked by the refusal of the Pikesville & Reisterstown Turnpike Company to grant right of way on reasonable terms.

This road is one of the best public roads in the State of Maryland. It was built over 90 years ago at great expense for travel by stage between Baltimore and Pittsburgh. It is so straight that the Pikesville & Emory Grove electric line, after a short turn in running out of Pikesville, does not change its course for nine miles, while the extension from Reisterstown to Union Mills would be practically an air line; and if the road should be extended 17 miles further to Gettysburg, as has been proposed, the distance between Baltimore and that place would be 50 miles, as against 72 by the Western Maryland Railroad, showing the advantage which the trolley has over the locomotive in accommodating itself to the natural topography of the country.

The completion of the Pikesville, Reisterstown & Emory Grove Railroad has brought up the question of competition between steam and electricity in Maryland. The round-trip fare on the electric road is 50 cents, while the regular fare on the Western Maryland Railroad to Emory Grove and return, which was $1 previous to the opening of the electric road, has also been reduced to 50 cents. The two roads are thus bidding for traffic at the rate of one and one-quarter cents per mile.

Electrical Items Worth Remembering.

Dropping a steel magnet, or vibrating it in other ways, diminishes its magnetism.

It is said that steel containing 12 per cent of manganese cannot be magnetized.

Flames and currents of very hot air are good conductors of electricity. An electrified body, placed near a flame, soon loses its charge.

In charging a secondary battery, the charging electro-motive force should not exceed the electro-motive force of the battery more than five per cent.

Lightning has an electro-motive force of 3,500,000 volts and a current of 14,000,000 amperes. The duration of the discharge of lightning is $\frac{1}{20000}$ of a second.

The resistance of copper rises about 0.21 per cent for each degree Fahrenheit, or about 0.38 for each degree centigrade.

A lightning rod is the seat of a continuous current, so long as the earth at its base and the air at its apex are of different potentials.

The rate of transmission on Atlantic cables is 18 words of five letters each per minute. With the "duplex" this rate of transmission is nearly doubled.

The effect of age and of strong currents on German silver is to render it brittle. A similar change takes place in an alloy of gold and silver.

To obtain the number of turns of wire in an electro-magnet, multiply the thickness of the coils by the length and divide by the diameter of the wire squared.

A test for the porosity of porous cells consists in filling the cell with clean water and taking the per cent of leakage. The correct amount of leakage is 15 per cent in 24 hours.

If the air had been as good a conductor of electricity as copper, says Professor Alfred Daniell, we would probably never have known anything about electricity, for our attention would never have been directed to any electrical phenomena.

A perfect vacuum is a perfect insulator. It is possible to exhaust a tube so perfectly that no electric machine can send a spark through the vacuous space, even when the space is only one centimetre.

For resistance coils for moderately heavy currents hoop-iron bent into zig-zag shape answers very well. One yard of hoop-iron one-half inch wide and $\frac{1}{32}$ inch thick measures about $\frac{1}{100}$ of an ohm, consequently 100 yards will be required to measure an ohm.

The voltage of a secondary battery must always be equal to or slightly in excess of the voltage of the lamp to be burned. For example, a 20-volt lamp will require 10 secondary cells, but 10 cells will supply more than 20 lamps.

FIG. 3.—ZIG-ZAG TRAIL UP THE MOUNTAIN, SILVERTON, COLO.

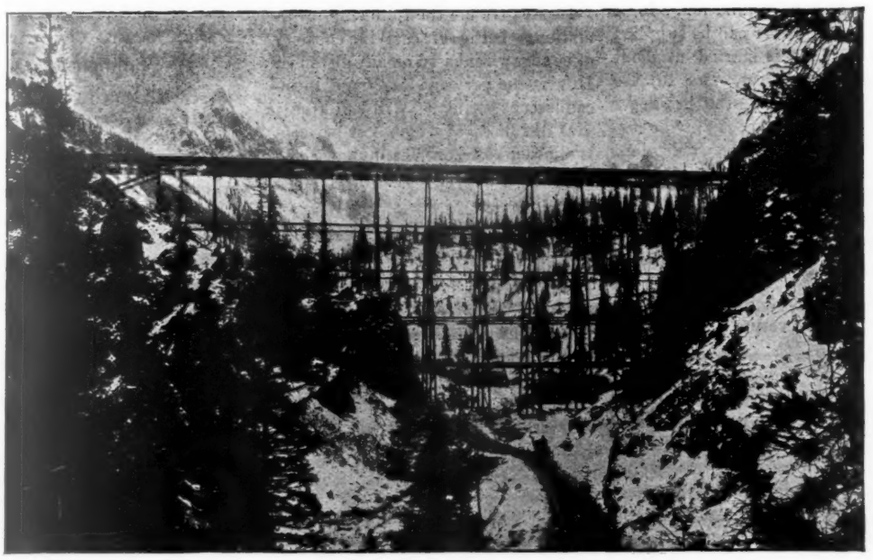


FIG. 4.—THE FLUME, SILVERTON, COLO.

Compression of air increases its dielectric strength. Cailletet found that dry air compressed to a pressure of 40 or 50 atmospheres resisted the passage through it of a spark from a powerful induction coil, while the discharge points were only 0.05 centimetre apart.

An accumulator with 17 plates, 10 by 12 inches, is reckoned, in horse-power hours, equal to about one horse-power hour. Taking this as a basis, it will require 6 cells for one horse-power for six hours, or 30 cells for five horse-power for the same length of time.

To obtain the length of wire on an electro-magnet, add the thickness of the coils to the diameter of the core outside of the insulation, multiply by 3.14, again by the length, and again by the thickness of the coils, and divide by the diameter of the wire squared.

Blotting paper, saturated with a solution of iodide potassium, to which a little starch paste has been added, forms a chemical test paper for testing weak currents. When the paper (slightly damp) is placed between the terminals of a battery, a blue stain appears at the anode, or wire connected with the carbon or positive pole of the battery.

The conductivity of metals decreases and that of some bad conductors or insulators increases with the temperature.

A current of one ampere, flowing through a resistance of one ohm, develops therein 0.24 heat unit per second.

Printers' roll composition makes an excellent flexible mould, but in electrotyping it can safely be used only in a saturated plating solution.

A horseshoe magnet will lift a load three or four times as great as a bar magnet of the same weight will lift.

One legal ohm equals 1.0112 British Association units; hence, to transform resistances expressed in British Association units to legal ohms, the numerical values have to be reduced by about one-tenth per cent.

Plumbago brushed over the face of a medal or other metallic object—an electrotype copy of which is desired in intaglio—will prevent the copper or other metal electrically deposited from adhering.

In winding an armature, if it is found a coil has been wound in the wrong direction, it is unnecessary to unwind it. It is just as well to reverse the connections with the commutator.

Field magnet cores for ring machines should be 1.66 times the diameter of the armature core, if of wrought-iron, or three times if of cast-iron. For drum machines the figures are 1.25 and 2.3.

In designing a dynamo, the field magnet should be as strong as possible. An increase in the strength of the field increases the induction, and the electro-motive force, or what amounts to the same thing, permits of decreasing the length of the armature for a given voltage.

Gutta-percha heated in hot water at about 100 degrees Fahrenheit becomes plastic and will take a fine impression with slight pressure. When gutta-percha is soaked for a few hours in benzole or naphtha, it becomes swollen and, if it is then dipped in hot water, it becomes so plastic that it may be used with safety on very fragile and delicate objects. Specially adapted to electrotyping.

In two-pole dynamos the proportions of ring armatures vary from a length equal to one-half the diameter to a length equal to one and one-half diameters. It is common to make the length equal to the diameter. For drum armatures the length sometimes equals one and one-half diameters and sometimes three diameters. It is common to find the length equal to two diameters.

According to Hering, with a suitable field magnet, every foot of active wire on the armature of a dynamo will generate about 1.2 volts, when the velocity of the wire is about 40 feet per second. As the wire, which lies in the neutral part of the field, is 20 to 25 per cent of the whole amount of wire on the cylindrical surface, the active part is 75 to 80 per cent of the whole. For 110 volts the length of active wire will be $110 \div 1.2 = 92$ feet of active wire, which must be embraced by one pole-piece. On account of the winding being in two halves, in multiple arc, the length of active wire on one-half of the armature surface will be $92 \div 0.75 = 123$, the whole length of active wire being 246 feet. The size of the wire will be determined by the allowable resistance.—*Scientific American.*

Long-Distance Transmission Plant at Fresno, Cal.

An interesting long-distance power transmission plant is in course of construction at Fresno, Cal., which is unique in more than one particular. The head of water to be used is 1,410 feet and the distance of transmission about 35 miles. The natural conditions surrounding the installation are extraordinary in themselves. The water for supplying the power is taken from the North Fork of the San Joaquin River. The stream of the North Fork runs for several miles down a rocky canyon, forming rapids and cataracts as it runs between the steep mountains. At the head of the rapids a canal will take the water out upon the summit of a high ridge, which it will follow for six miles to a point nearly 1,500 feet above the San Joaquin River. Here a reservoir has been constructed with an average depth of 10 feet. It covers about eight acres and can be made both larger and deeper, should the demand for power require an extension. Into this reservoir the water brought along the ridge by the canal will be stored, but it will be used solely as an emergency store. It is calculated that it will hold enough water to drive the machinery for several days, so that should a break occur between the reservoir and the source of supply, the electrical work could continue until the repair was effected.

A pipe line runs directly from the canal a distance of about 4,000 feet to the power house, and the head of water obtained will not be less than 1,410 feet. The pressure at the bottom will be 600 pounds to the square inch. The lower end of the pipe line is of welded steel pipe, three-quarters of an inch in thickness, having special steel flanges and special packing at the joints. The lowest amount of water-power available is at least 7,000 horse-power at the head above mentioned. All possible accidents are provided against. Should a break occur near the lower end of the pipe the rush of water would form a vacuum near the upper portion of the pipe and it might collapse under atmospheric pressure. An air valve will be placed near the top to provide against this contingency. The pipes will be made in sections of 20 feet each. At the upper end the metal will be one-quarter inch thick and the pipe 24 inches in diameter. It will be fastened to the solid granite mountain sides by steel cables.

The power station will be located at the bottom of the mountain, and will contain three Pelton water-wheels, 58 inches in diameter, driven by a single nozzle. The generating plant will consist of three 340-kilowatt General Electric Company's three-phase generators. The three-phase system has been selected in this case as the system which will give the highest efficiency of transmission with the lowest cost of copper.

From the point in the North Fork of the San Joaquin River, where the water is taken to the power house at the foot of the mountain, is a distance of about seven miles. From the power house to Fresno, where the electricity will be utilized, is about 31½ miles in a direct line, or 35 miles over the electric wires. The line will consist of two circuits of bare copper wire, consisting of six wires strung on poles 40 feet high. The current will be delivered to the lines at a voltage of 11,000 volts. From the power house the line will rise to the level of the San Joaquin, cross it and pass through a portion of the Auberry Valley, then rising over the Red Mountain, passing about a mile west of Clovis, will continue direct on to Fresno. The first five miles will be over moderately level country, the other 30 through an open and practically level country under ideal conditions for transmission. It is estimated that the power which will be delivered in Fresno at present from the three-phase generators will not be less than 900 horse-power.

At the Fresno end the line will be brought into a sub-station and the current will be transformed down. From the sub-station power will be delivered to all the mills in town, the waterworks, machine shops, planing mills, laundries, printing presses, elevators, packing houses, etc. It will also be used to drive the street railway system of the city, which will require about 300 horse-power. In the sub-station, two arc dynamos, each of 60 lamps capacity, will be driven by an induction motor, the motor being mounted on the same bed plate as, and being direct connected to, the dynamo. Current will be supplied for 4,400 incandescent lamps.

Gas and fuel in the San Joaquin Valley has always brought an extremely high price, and this may be considered as the most potent reason for the present installation. It is believed that power can be supplied when the plant is started at about half its present cost, and to the towns around Fresno the privileges of electricity will probably be extended as soon as possible. This plant may easily be considered as taking the lead in the use of a high head of water and the distance over which the power is transmitted.

Complaint About Service on the Lenox Avenue Line.

To the Editor of Electrical Review:

Last night I waited at Lenox avenue and 130th street for a down-town car on the Lenox avenue underground conduit line from 8.55 to 9.15—just 20 minutes. Six cars going uptown passed me during this time. The car I boarded was well filled and when hailed at several cross streets further down by waiting passengers skimmed right by them without any pretense of stopping. Four passengers were waiting at the 116th street curve but the car took the curve at nearly full speed and didn't stop for them.

Don't you think this is poor service and bad policy for a new road?

Yours truly,

MANHATTAN.

New York, August 16.

SEEKING INFORMATION.

A LIST OF QUERIES FROM OUR READERS —ANSWERS WILL BE PUBLISHED IF SENT TO THIS OFFICE.

WILL SOME BATTERY EXPERT ANSWER?

To the Editor of Electrical Review:

Will you tell me what is the average life of a Fuller bichromate battery on a closed circuit that is open, say, five hours in 24. I mean that the time it is open is five hours, but not five hours continuously.

I have used above battery on solid back transmitters, but the conditions of installation varied so that I have never been able to satisfy myself whether it is a reliable battery or not; but, assuming that it was properly put up, would you advise its use instead of an ordinary gravity battery for telegraph work?

I hope you will not consider this question an imposition on your good nature, for you know I have come to regard the Review as my best friend in the business. LINEMAN.

Mt. Savage, Md., August 16.

ABOUT LIGHTNING BOLTS.

To the Editor of Electrical Review:

Does lightning ever strike a wire in a storm, especially if very much isolated from other wires? Does any danger arise if wire is properly put up and insulated and lightning arresters used?

We are very much pleased with your paper. Respectfully,

CHAS. JENKIN.

Minco, I. T., August 15.

CARRYING CAPACITY OF WIRE.

To the Editor of Electrical Review:

Please give me the following information: Is the safe carrying capacity of copper wires based on any distance? How is the per cent loss found in incandescent wiring? Will you kindly give distances at which loss per cent is allowed both for Westinghouse and Edison systems? An early reply would greatly oblige, yours truly,

T. L. CULLEN.

New York, August 17, 1895.

WIRING OF STREET CARS.

To the Editor of Electrical Review:

Can you tell me where I can procure cuts of car wiring of path of current? S.

Deering, Me., August 19.

Siemens-Halske Electric Railway System.

Mr. Chas. T. Yerkes is reported as saying that "the Siemens-Halske company will manufacture motors and all kinds of electrical appliances, and will also build motor engines for both heavy and light railway traffic. They believe they have solved the problem of economical operation on both heavy and light traffic, and shall open an office in the American Surety Building in New York and exhibit models of their railway system there."

Therapeutics of High-Frequency Currents.

The paper read by Dr. Apostoli on this subject at the meeting of the British Medical Association is an important one and represents the direct practical application of the physiological facts brought out by D'Arsonval's experiments with animals. The current of high frequency and high potential is caused to traverse a large helix inside which the patient is placed and the effect is to set up induction currents of a similar kind inside the patient's body. These travel in closed circuits through the tissues and produce nutritive changes, which can be recognized by their effect in increasing the elimination of carbon dioxide and of urea. The actual figures are promised at an early date. The results are good in diseases characterized by failure or impairment of nutrition, and accordingly Dr. Apostoli reports successes in anæmia and debility, gout, rheumatism, neurasthenia and hysteria. In diabetes also there have been some favorable cases. The principle of the localized application of electricity for the relief of disease, so ably insisted upon by Duchenne, has delayed the recognition of the important general effects to be obtained from electrical treatment. At present there is a distinct movement in favor of general electrification as a therapeutic means, and the results appear to be almost identical in character, whether the method employed be by the alternate current electric bath, advocated by Gautier and Laret, or the high potential induction method of D'Arsonval and Apostoli, or the electrostatic methods favored by Vigouroux and Morton, of New York, who use the Wimshurst or some similar machine as the source of the electricity applied.—*London Lancet.*

Electric Meter Competition in Edinburgh.

The Royal Scottish Society of Arts, of 117 Great George street, Edinburgh, offers for competition a Keith prize of £50, for improvements in electric energy meters for domestic supply, says London *Engineering*. Competitors must send a description, with working drawings, and a meter adjusted for a mean pressure of 115 volts, and for a maximum of 4,000 watts. Preference will be given to meters suitable for alternate as well as continuous currents. Special importance will be attached to the minimum load at which the meter can register correctly, and to the energy absorbed by the meter when the consumer is using a light load or is taking no energy at all. The error should not exceed two per cent at any load; error due to changes of temperature between 0 degree and 30 degrees centigrade should be specified. The competitors must send in their papers, etc., not later than May 1, 1896. Their claims must be limited to recent improvements.

American Association for The Advancement of Science.

The forty-fourth meeting of this association will be held at Springfield, Mass., from August 28 to September 7, 1895.

THE SENATOR INVENTS A TROLLEY FENDER.

BY FRANK CAWLEY IN THE "AMERICAN MACHINIST."

My friend, the Senator, has invented a fender. I will not mention his constituency nor even his nationality, for any one can invent so simple a thing as a fender.

The Senator's fender, however, had some peculiar features about it which made it different from other fenders; for instance, it was a very humane fender; any child could use it and imagine that he was swinging in a hammock or peacefully sleeping on the maternal breast. Likewise dogs and thin men and fat women who have just got off the other car backwards, all could seek calm repose on this most humane fender.

Then, again, it was a very cheap fender, and the trolley companies could easily afford to put one on the business end of every motor car, even when both ends were business ends. Moreover, these companies when very young, or immediately after the last strike, are sometimes in financial straits. In such cases one fender can easily be made to do for both business ends. For is it not light, and has it not two side pieces and two wheels which together make a most beautiful whirligig which it should be a pleasure for the sportive motorman to push like a perambulator to the other end of the car while the conductor counts his transfers and shifts the trolley pole—a pleasure even through banks of snow and depths of chilling mud?

In construction, as I have already mentioned, it consisted of two side rods hooked into eye bolts, one at each side of the front board of the car; an axle and two flanged wheels, and geared from this axle was the most important part of the whole, a rubber roller revolving backwards which would pick up anybody or anything that came within its reach and gently lay him, her, or it on the netting which surmounted the whole and was a part thereof. No extra royalty was to be charged for the gravel stones and dust which this roller would throw into the eyes of the patient motorman, or of the unsuspecting directors.

Under the netting were two diagonal stay rods, braces, I think, he called them, which were to keep the thing square and up to its work. Each of these rods had adjusting nuts, which were to allow them to be loosened enough to allow the fender to swing at curves. All this I learned from the Senator himself and from a blue print of a very finely executed perspective which had been prepared by the patent attorney and which showed the fender all ready for business attached to the front of a car.

Trouble was anticipated at curves and switches and at suburban points where the small boy is omnipotent, and the fender was provided with a lever with which the motorman could easily lift it over bricks, toy houses, etc., which might not be wanted on the netting. This lever was, of course, not shown (they never are), but it was very simple, and in arranging for the construction I could easily put it in. It is, by the way, a very useful thing to know—young inventors, please take notice—that a lever, especially a bell crank lever, together with the pressure of the little finger, can accomplish any mechanical feat, and usually in such simple manner that it is quite unnecessary to show it.

My first real introduction to this fender took place at a pre-arranged meeting between the Senator, the foreman of a machine shop and myself. The foreman was to give an off-hand estimate of the cost of building, and I was to arrange details and superintend construction. Work could be begun immediately, and the fender was to be ready for trial next Saturday.

It is hardly necessary to inform the mechanical reader that none of these things came to pass. The foreman could make no estimate from the data given us; I could give no details until I had made some sketches to scale; and construction could not possibly begin until this had been done.

That evening a very short interview with my drawing instruments told me that my doubts were well founded, and it made no difference which angle was used for the projections. *American Machinist* readers will understand this reference. Accordingly, when the Senator called next day, I was obliged to tell him that the stay rods would require about two feet of slack in them to admit of the fender swinging on curves, and that when on a curve the rod not in use would be two feet slacker, and would drag on the ground, and I advised him to leave them off altogether. I told him that, owing to the similarity between his fender and a parallel ruler, the axle of the fender would remain parallel to those of the car, and that on sharp curves instead of being radial with the curve, it would be inclined to the radius at about the same angle as is the shaft of the rotary sweepers—which are so useful in depositing the snow from the road-bed upon the sidewalk — and this angle would oblige the fender to make tracks rather than follow them. A lever to lift the fender, I explained, was altogether out of the question, for when the motorman had one hand on the brake and the other on the controlling crank, one foot trying to kick the gong loud enough to move a bread cart, and the other being required to stand on, not even a finger remained to operate a bell crank. And men with more hands or feet than the ordinary *genus homo* can make more money as freaks than they can command for kicking bells and pulling levers for the trolley company.

The lightness of the fender disappeared when details began, and instead of the motorman of a financially embarrassed road moving the fender gayly from one end of the car to the other, conductor and motorman together would be glad to drop it.

As a final reason why he should not take contracts for the supply of these fenders in a hurry, I told him to look up the catalogue marked "Fenders in the United States Patent Office" and that he would find that he had a dozen patents (each equally dear to its inventor as was his invention to him) to purchase before he could save the life of one small boy who, as boys delight to do, was innocently playing tag with the trolley cars.

This interview, I am afraid, killed one, at least, of those remarkable inventions, which occasionally find their way into the daily papers. I have seen little of my friend since then and nothing of his fender.

In all the essential parts the above narrative is true, and I have written it to add a little to the sound advice already given in these columns to would-be inventors: Don't be in too big a hurry. If you don't know, perhaps some good friend who does know about pumps, locomotives, or whatever else your invention is to improve, may tell you, and above all find out what has already been invented.

A Toy Electric Motor.

The accompanying cut illustrates one of the smallest practical electric motors ever made. It is three

A TOY ELECTRIC MOTOR.

inches high and has a practical field, armature, commutator and commutator brushes, and is used with a battery for propelling toy boats and cars. The manufacturer, M. R. Rodrigues, 17 and 19 Whipple street, Brooklyn, N. Y., experimented for several years before he was able to make the little machine substantial enough to accomplish any practical results.

ELECTRIC LIGHT FLASHES.

The electric light plant at Pawnee City, Neb., is finished and ready for operation.

It is stated that the Southern Pacific will use electric headlights on all its locomotives.

An electric lighting plant to supply Wells College and the village of Aurora, N. Y., is in process of construction.

The Phœnix, Ariz., Electric Light and Fuel Company has purchased J. J. Gardiner's electric light plant at a rumored price of $10,000.

The Common Council of Albany, N. Y., will give a public hearing on September 3, at 8 P. M., in the Council Chamber in the City Hall, on the pending question of city electric lighting.

The excavations for the foundations of the new building of the Chester, Pa., Electric Light Company are progressing, but it will be some weeks yet before the foundations are completed.

Frank B. Rae has been selected by the Rockford, Ill., council as the electrical engineer to draw the plans and superintend the construction of the new electric lighting plant to be put in and owned by the city.

Among the yachts on which the chloride accumulator has been installed for lighting purposes this season are "Linta," "Sultana," "Alcedo," "Duquesne," "Huntress," "Washita," "Vidette" and "Thespia."

Three men went to the Duane street office of the Edison Electric Illuminating Company of New York city last Friday night and tried to exchange a number of burned out incandescent lamps for new ones. The men said they had been sent from the Manhattan Club. A telephone message developed the fact that the club had not sent for any new lamps and the men were arrested.

Fremont is the first city of Nebraska to take advantage of the new law permitting municipal ownership of electric lighting plants. The city will furnish arc and incandescent lamps at reduced prices. Material is already beginning to arrive for the construction of the plant. Work will be commenced on the building and machinery very soon and it will be completed and in running order by October 1, the time called for by the contract.

The City Council of Chester, Pa., has passed an electric light ordinance over the Mayor's veto. This ordinance provides for a new contract with a new company with a saving of $16,300 to the city over former contracts. The contract is for five years. It was the most important ordinance before council in many years, and it has been blocked at every stage of progress by injunction and other methods, but is now a law. A contract has been approved by Controller Hawthorne.

No bid was received from the Milwaukee Arc Lighting Company upon the city lighting on August 19 and the reason for the withdrawal of that corporation from the competition is that it is now to all intents and purposes a part of the large properties owned and controlled by the Milwaukee Street Railway Company. Only one set of bids was entered. These were from the Badger Illuminating Company, or, rather, the Milwaukee Street Railway Company, for the bids are now made in the name of the parent corporation. The company's offer on a five-year contract was $109 per lamp, for lights on underground circuits. If, however, it were allowed to string its wires overhead it offered to furnish all lights on overhead circuits for $92 a lamp. If given a ten-year contract, the company offered to furnish lights on underground circuits for $105 and on overhead circuits for $87 per lamp.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 2389. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW." NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 800 H St., N. W.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10
Back Copies, each, - - - - - - .25

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, AUG. 28, 1895.

CONTENTS.

PAGE

Views, News and Interviews ... 113
Three-Phase Long-Distance Transmission for Mining Work ... 113
Electric and Steam Road Competition in Maryland ... 114
Electrical Items Worth Remembering ... 115
Long-Distance Transmission Plant at Fresno, Cal. ... 116
Complaint About Service on the Lenox Avenue Line ... 116
Seeking Information ... 116
Siemens-Halske Electric Railway System ... 116
Therapeutics of High-Frequency Currents ... 116
Electric Meter Competition in Edinburgh ... 116
American Association for the Advancement of Science ... 116
The Senator Invents a Trolley Fender ... 117
A Toy Electric Motor ... 117
Electric Light Flashes ... 117
Wall Street and the Electrical Stock Market ... 118
Our Boston Letter ... 119
The Montreal Street Railway Convention ... 119
Bribing Competitors ... 119
This Architect Doesn't Want any Kinky Wire in His ... 119
Death of Henry Metzger ... 119
Death of Wm. F. Forby ... 119
Electric Railway Notes ... 119
Telephone News and Comment ... 120
Taylor's Patent Bookholder for Telephone Directories ... 121
A Cable to Honolulu ... 121
Kind Words ... 121
Literary ... 121
Commercial Cable Company's New Building ... 121
Respiration, Suffocation and Resuscitation ... 121
Electric Power for Mining in Australia ... 122
Jaeger Electric Lamp Company Sold Out ... 122
Daily Insulation Testing of Telegraph Lines ... 123
Obituary ... 123
Personal ... 123
Advance Information ... 124
Electrical Patents ... 126
Business Notes ... xi
Kindred Interests ... xii

INDEX OF ADVERTISERS.

COVER PAGES. PAGE

Abendroth & Root Mfg. Co., boilers ... xviii
American Electrical Works, insulated wire ... i
Armington & Sims, engines ... xviii
Boudreaux Dynamo Brush Co., a new foliated anti-friction metal brush ... i
Bristol Co., meters ... i
Bryant Electric Co., kilowatts ... xviii
Bunnell & Co., J. H., dry batteries ... i
Columbia Incandescent Lamp Co. ... i
Ayr's Kerite, insulated wire ... i, x
Eastern Electric Cable Co., ... xviii
Goubert Manufacturing Co., heaters ... xviii
Greeley, E. S., & Co., electrical supplies ... xviii
Hampson, E. P., & Co., engines ... xviii
Interior Conduit and Insulation Co., Lundell dynamos and motors ... i
Law Battery Co., open circuit batteries ... i
National India Rubber Co., wires and cables ... i
Okonite Co., insulated wire ... i, xviii
Partridge Carbon Company, motor and generator brushes ... i
Phœnix Glass Co., globes and shades ... i
Safety Insulated Wire and Cable Co. ... i
Standard Underground Cable Co. ... i
Stirling Co., water tube boilers ... xviii
U. S. Telephone Construction Co., "M. & B." telephones ... i
Western Telephone Construction Co., telephones ... xvii
Westinghouse Electric & Mfg. Co., railway generators and motors ... ii
Weston Engine Co., engines ... i

INSIDE PAGES.

Allen, L. B., soldering sticks ... xii
American Bell Telephone Co. ... xv
American Electric Telephone Co., long-distant telephones ... xiv
Ballard, E. V ... xi
Bain, Forée, engineer ... 126
Baker & Co., platinum ... viii
Baxter, H. E., & Co., electrical supplies ... x
Beacon Lamp Co., incandescent lamps ... xii
Belden Machine Co., drop forging ... xi
Benjamin, Geo. H., patents ... xiv
Berliner Telephone Co. ... xv
Bickford & Francis Belting Co., leather ... xvi
Boynton Multivolt Battery Co. ... 126
Bradbury-Stone Electric Storage Co., storage batteries ... xi
Brill, J. G., Co., railway cars ... xiii
Brixey, W. R., Day's kerite wires and cables ... x
Brush Electric Co., arc lamps ... vi
Buckeye Electric Co., incandescent lamps ... v
Cash Buyer's Union, bicycles ... xiv
Central Electric Co., incandescent light supplies ... iii
Chapman Valve Mfg. Co. ... v
Chisholm, A., & Co., commutator compound ... 125
Colgate Company, Geo. L., lightning arrester ... 126
Connecticut Pipe Mfg. Co. ... vi
Consolidated Telegraph and News Co. ... xi
Corey, R. B., arc lamps ... iii
Crocker-Wheeler Electric Co. ... 125
Darlington, F. W., consulting engineer ... xvi
De Ronde, A. & Co., carbons ... iv, x
De Veau & Co., telephones ... xiv
Dixon, Jos., Crucible Co., belt dressing ... xiii
Dudley Electric Manufacturing Company, individual telephone signal ... xiv
Duval, W. S., Jr., patents ... 126
Dyer & Driscoll, patent solicitors ... 126
Eddy Electric Mfg. Co., Eddy generators ... xiii
Electric Launch Co. ... xvi
Electric Storage Battery Co., chloride accumulators ... vii
Empire China Works, porcelain specialties ... viii
Eppenger & Russell Co., Valentine subway electrical conduit ... xi
Euler, H. C., mother-of-pearl ... 126
Faraday Carbon Co., carbons ... 126
Fleming, W. H., woven wire dynamo brushes ... xi
Forest City Electric Works, commutator bars ... v
Fort Wayne Electric Corporation, "Wood" ammeters ... v
Garlock Packing Co. ... viii
General Electric Co., Edison lamp test ... ix
Globe Electric Construction Co., general contractors ... xvi
Globe Electric Light Co., incandescent lamps ... vi
Globe Metal Works, refiners of platinum ... viii
Harrisburg Foundry & Machine Co., Harrisburg ideal engines ... vi
Homer, F. E., & Co., commutators ... xvi
Hooven, Owens & Rentschler Co., electric railway and electric light engines ... iii
Huebel & Manger, table push ... viii
Independent Electric Co., fuse wire ... xii
International Correspondence Schools ... viii
Keystone Telephone Co. ... 126
Lane & Bodley, street railway engines ... iv
Leffel, Jas., & Co., water-wheels ... v
Lehigh Valley Creosoting Co., creosoted lumber ... 126
Lockwood Telephones ... xv
Lozier, H. A., & Co., Cleveland bicycles ... xiv
Marshall, Wm., condensers ... viii
McIntire, The C., Co., connectors and terminals ... 126
Metropolitan Chandelier and Electric Supply Works ... 126
Metropolitan Electric Co., fans ... v
Metropolitan Telephone and Telegraph Co. ... xv
Moore, Alfred F., insulated electric wire ... xiv
Morris, Tasker & Co., poles and tubes ... xii
National Telephone Mfg. Co., telephones ... xv
New England Engineering Co. ... xiii
New York Belting and Packing Co., rubber belts ... iv
New York Insulated Wire Co ... xv
New York & Ohio Co., Packard lamps ... viii
Ostrander & Co., W. R., supplies ... 126
Partrick & Carter Co., electrical supplies for housework ... 126
Pemsel, Friedr., electric light and battery carbons ... iii
Penberthy Injector Co. ... xvi
Pennsylvania Street Railway Association meeting ... viii
Philadelphia Telephone Co., Blake transmitter ... xiv
Phillips Insulated Wire Co., wire ... 125
Pope Manufacturing Co., Columbia bicycle ... xiv
Positions Wanted ... xi
Proposals, City of Cleveland ... 126
Read, Robt. H., patents ... 126
Replogle Governor Works ... x
Rodrigues, M. R., premier baby ... xiv
Royce & Marean, electrical supplies ... 125
Sanger, M. E., & Co., experimental and model works ... xii
Scott Electric Lamp Co. ... viii
Self-Winding Clock Co., clocks ... xvi
S. K. C. Electric Co. ... viii
Smith, Jas., Woolen Machinery Co. ... xvi
Solar Carbon and Mfg. Co., carbon specialties ... xvi
Standard Electric Co., arc lighting ... xii
Standard Thermometer Co., arc lamps ... xiii
Stanley Electric Mfg. Co., S. K. C. two-phase system ... vii
Stanley & Patterson, electrical supplies ... vi
Stevens, H. L. C., photo-engraving ... iv
Stucky & Heck Electric Manufacturing Co. ... xvi
Thayer Electric Co., electrical engineers ... xvi
Varley Duplex Magnet Co., magnets ... xiv
Walker Mfg. Co., railway motors ... iii
Wanted Specialty ... 126
Warren Webster & Co., vacuum system ... v
Waterman, Chas. H., arc lamps ... viii
Western Electric Co., supplies ... x
Weston Electrical Instrument Co., measuring instruments ... x
White-Crosby Co., contracting engineers ... xi
Wilkinson, W. H., automatic wiping device ... xii
Worthington, H. L., electric signs, etc. ... iv
Zogg, Nicholas ... 125

To President Wilmerding, of the National Electric Light Association: Wouldn't it be well to call a meeting of that electrical exhibition committee before it's time to hold the next convention?

On account of Monday, September 2, being a legal holiday, the ELECTRICAL REVIEW for September 4 will go to press one day earlier than usual. Contributors and advertisers will kindly take notice of this fact.

A prominent manufacturer of New England writes to the ELECTRICAL REVIEW, under date of August 24, as follows: "I desire to express my appreciation of your editorial entitled, 'What is there in it for me?' and was very much interested in the account of the change of chief engineers of the Philadelphia Traction Company. Keep up the good work." We will.

The New York *Tribune*, in recent comments on the incandescent lamp situation, stated that "the continued lowering of the price has driven many of the small factories out of business, and only about half a dozen concerns outside of the Edison company are in the market to-day, but these are vigorous and vexatious competitors." For the information of our daily contemporary we would state that there are now in operation in the United States more than 20 incandescent lamp manufacturing companies making a daily product estimated at 30,000 lamps.

THREE-CENT STREET-CAR FARES.

The New York State Assembly has appointed a committee to investigate the street railway companies of the State with a view to compelling by law the adoption of a three-cent street-car fare. The committee has found in Buffalo, so it is reported, that such a fare is not only possible but would be profitable. Low street-car fares are certainly a great boon to the working people, but we do not believe that the intricate and money-saving transfer systems in operation in many cities could be supported on a three-cent fare. If the transfer system were forced out of existence, we do not see wherein the working man would benefit by three-cent fares, because for a ride that now costs him five cents he would in many cases be obliged to pay six cents or nine cents. Then, too, if the three-cent scheme is insisted upon, some distinction should certainly be made between a metropolitan and a village street railway system. What would ruin one might accrue to the benefit of the other. It is safe to say that no legislative committee can figure out for a street railway company any scheme to make money; if there were profit in three-cent fares the street railways of New York State would have adopted them long ago.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

The stock market of the week was quiet, and, barring the professional attack on some of the industrials, was without salient features. As a rule this class of securities ended at about opening figures, while those of the railroads closed somewhat higher. The most important development in the business world was the reduction in sterling exchange, due to the appearance of produce and cotton bills. The rate is now $4.90 for demand exchange and is very close to the exporting point. From this it is concluded that the outward movement of gold will soon be stopped for this year. Trade reports are still quite bullish in tone, indicating the establishment of business upon the high level of prices recorded in previous weeks. The demand is good especially in those lines dependent upon a good crop. The corn crop is one week nearer safety, and inside of the next seven days, if it meet with no important setback, will be assured.

The week in the electrical stocks was very quiet as compared with the one preceding. Talk on General Electric in speculative circles was quite bullish. The stock was steady at very little change in quotations around 37. The statement was made during the week that the company did not earn more than 3 per cent during the year and that the management will be satisfied with that amount. This figure after providing for the preferred dividend and the fixed charges in view of the sharp business competition would be a fair return. I do not hear of any talk of a resumption of dividends on the preferred, either current or accrued, and it is the understanding that the subject has not been seriously considered by the management. There is a steady demand for the 5 per cent debenture bonds around 90. This week the belief is that the company is still buying them in from time to time, as it has available cash, calculating in this way to correct its capital impairment, at least in part. The company has not paid any dividends on its $4,252,000 7 per cent preferred stock since July 1, 1893. These dividends are cumulative, inclusive of the July, 1895, payment, which is due as well as the others, and the total amount which must eventually be paid is $595,280. It is just possible that the money available for this purpose is being invested in the company's debentures until such time as the capital impairment is so lessened as to permit its payment to the preferred stockholders.

A stock which was prominent again this week was Electric Storage Battery. The price was steady between 44 and 45 on very fair buying. There was free talk of an opposition company to be organized. Supporting orders came from people who were not only familiar with the company's earnings but believe that the patents it owns preclude the possibility of any serious rivalry.

Among the electrical stocks on the New York Stock Exchange, less active, Edison Electric Illuminating of New York sold at 99 and par. The old 5 per cent bonds recorded transactions at 109½, the new consolidated bonds 103¼. Brooklyn Illuminating lists sold at 111⅞.

On the Boston Exchange, Bell Telephone weakened somewhat under speculative influences, declining from 199 to 197½. Erie Telephone lost 2½ to 54½. New England Telephone was firm at 88½. Westinghouse common was steady at 36½ to 37½. The preferred was firm at 54 to 54½.

BAIN.

New York, Aug. 24, 1895.

OUR BOSTON LETTER.

Representative railroad men and others prominent in business and political circles throughout New England to the number of 150 or more gathered at the Union station on Wednesday morning last in response to the invitation of the Massachusetts Street Railway Association to participate in the regular mid-Summer outing of that organization. A special car attached to the regular nine o'clock express for the north conveyed the party as far as Lowell, where they were met by the local delegation and escorted to the special electrics of the Lowell, Lawrence & Haverhill road which were to carry them to Lawrence. After a stop at "Glen Forest" for a brief inspection, the trip to Lawrence was resumed, and from there to Haverhill, at which place a steamer was in waiting to carry the party to "The Pines," a delightful resort on the shores of the Merrimac, owned by the street railway company, at which place dinner was served. After the bountiful collation was disposed of, a few informal remarks by some of the prominent men present were in order, among them being State Treasurer Shaw, Josiah Quincy, Jas. H. Eaton, treasurer of the Essex Savings Bank, and Mr. Brown, of the Westinghouse Electric Company. An additional half hour was spent in watching a very enjoyable entertainment furnished by the management, and the party then adjourned to the steamer for a run down the river as far as Newburyport. Lunch was served on the boat, and after a short stop at Newburyport the steamer was again headed for Haverhill, where the party dispersed with many congratulations over the entire success of the day.

The formal opening of the Gloucester, Essex & Beverly road, furnishing electric traction between the above named towns, took place on Monday the 19th inst., and was the occasion of a general celebration by the officials and citizens of that section. The new road opens up one of the prettiest sections in Massachusetts, and by connections with the Salem and Lynn systems, makes it possible for a continuous passage to be made from Gloucester to Boston by electric cars. The occasion of the opening of the new line was made a public holiday, and the citizens of the section turned out *en masse* to swell the celebration. After the invited guests had been taken over the line and inspected the fine power plant at Essex Falls they returned to Gloucester, where a banquet was served to over 200, followed by speeches and words of congratulation from prominent officials, all tending towards the benefits to be derived from the closer relations between the towns made possible by the new road. A feature of the afternoon ceremonies was a historical parade, showing the various stages of development of rapid transit from 1620 to the present day, and consisting of horsemen, the ancient "one horse shay," stage coaches of 100 years ago and a modern tally-ho, one of the first horse cars used on the road and last, but not least, the handsomely decorated electrics of the present. The celebration, which will long be remembered by the "natives," wound up with band concerts and fireworks in the evening, and it can justly be said that the new electric system was ushered in in a blaze of glory.

The Whitney Electrical Instrument Company, of Penacook, N. H., are early feeling the impetus of an improved Fall trade and, as usual, are making preparations to meet it half way. Orders for their various lines of instruments are coming in with satisfactory regularity and are being filled as rapidly as possible. The several new instruments put on the market by the Whitney company within the past year are all meeting with gratifying success and have encouraged them towards further efforts of the kind. What is destined to prove a very valuable instrument, though in rather a different line from their past productions, is almost ready for the market and will be heard from in the near future.

The Brodie Electric Company, of Manchester, N. H., are doing a flourishing business in their various specialties and have still something "up their sleeve" in the way of novelties, which will be heard from as fast as they can be got ready for the market. One of them is now rapidly nearing completion and readers of the REVIEW will be fully posted as to its merits in the not distant future. H. G. T.

Boston, August 24.

The Montreal Street Railway Convention.

The interest already shown in the next convention of the American Street Railway Association at Montreal, Canada, assures a large attendance in October next. Announcements for a special train from New York city are being made through a committee appointed by President Joel Hurt, consisting of the Secretary of the association, Col. John N. Partridge, of Brooklyn, and Messrs. J. H. McGraw, and Chas. W. Price, of New York. It is expected that the special will leave New York city Monday evening, October 14, arriving at Montreal Tuesday morning, October 15, in good time for the convention which meets at noon on that day. The return trip will probably be by daylight, the travelers leaving Montreal, Saturday A. M., arriving in New York that evening. This should be a delightful trip as the always interesting scenery along the route will be enhanced by the beautiful coloring of the Fall foliage.

The itinerary of the trip will be announced later. A fare of one and one-third for the round trip has been secured.

An extensive exhibition will be made in a suitable hall, and the Windsor Hotel will be association headquarters.

Several letters and telegrams have been received at the ELECTRICAL REVIEW office for Mr. George H. Osborne.

Bribing Competitors.

TO THE EDITOR OF ELECTRICAL REVIEW:

Since you are writing on the subject of "Bribe Giving and Taking," it might be well to touch a little on the collateral subject of a contractor buying or bribing (?) his competitors not to bid. I enclose you a clipping from the Passaic *Daily News* of a case of this kind which may be of interest to you, especially as it refers to an electrical contract. Query: Should not the suit have been thrown out of court on the ground that the agreements to pay $150 and to withdraw the bid are fraudulent and against public policy?

Yours truly,

MECHANICAL.

New York, August 23.

[*From the Passaic, N. J., Daily News, Aug. 18, 1895.*]

BOUGHT OFF HIS COMPETITORS.

Lemuel William Serrell was sued before Justice White, yesterday, by George W. Spencer, of Rutherford. Mr. Serrell is the contractor who is building the Passaic and Newark road. Mr. Spencer was one of his competitors for the job. Serrell offered him $150 to withdraw his bid and Spencer accepted. Serrell failing to pay, Spencer sued and Justice White gave judgment for the full amount and costs. It is said that Serrell bought off all his competitors for the Passaic and Newark job and that he has paid most of them the amounts promised.

This Architect Doesn't Want Any Kinky Wire in His.

TO THE EDITOR OF ELECTRICAL REVIEW:

I enclose you a copy of a part of a specification drawn up by a well-known architect here in town. If you would give it a place in your paper, I think it would interest not a few. Here it is:

"Provide and put up in each rear hall two good toned bells; one to ring from parlor and one from front door. All of best electric system with small neat wood and black button with furniture and strong insulated wire connection with battery box and key in cellar. All properly connected up and tested for kinks."

Isn't it a corker?

Yours truly, F. P.

St. Louis, August 22.

Death of Henry Metzger.

Mr. Henry Metzger, of Pittsburgh, for many years at the head of the Central District & Printing Company, which operated the Pittsburgh telephone exchange, as well as considerable territory in Western Pennsylvania and West Virginia, died Sunday forenoon.

Mr. Metzger had been ill for six months, and his death, which will be deplored by a very large circle of friends, was not unexpected. He was unmarried, and had lived in Pittsburgh nearly all his life, at one time being a member of the city council.

Death of Wm. F. Forby.

Wm. F. Forby, of the Okonite company, New York, died at Roxbury, Mass., on August 15 of Bright's disease, and was buried at his home in Albany the following Sunday. Mr. Forby had only been a member of the electrical fraternity for about two years, but had made a host of friends in that time, all of whom will greatly mourn his sudden decease. He had been connected with the Okonite company a year and a half and his services were so valued and he himself was so highly esteemed that the company keenly feels his loss.

ELECTRIC RAILWAY NOTES.

The foreclosure sale of the Denver City Cable Railway Company has been postponed until September 10.

The Philadelphia Traction Company states that 6 persons have been saved from death or injury by the fenders on its cars.

The Oneida, N. Y., Street Railway Company's report for the quarter ended June 30 shows a net income of $280. The capital stock of the company is $13,500.

C. T. Yerkes is quoted as saying that street railway lines having changed from horse to electric power show an average increase in gross traffic of 30 per cent.

In order to create travel for a branch line that is not doing very well, the Detroit Citizens' Street Railway Company has made a two and one-half cent fare during the hours from 7 to 10 P. M.

The Second Avenue Traction Company, of Pittsburgh, has issued an interesting illustrated pamphlet describing Calhoun Park and giving many facts and figures about the towns through which its lines pass.

The directors of the West End Street Railway Company, of Boston, have declared a three and one-half per cent common stock dividend, payable October 1. Books close September 14 and reopen September 23.

The directors of the Troy, N. Y., City Railway Company have decided to proceed at once with the construction of an addition to the Division street power house. A building 45x110 feet will be erected and a 1,000 horse-power engine placed in position.

The calendars of the coming terms of the Essex County, N. J., courts include suits for damages aggregating more than $1,000,000. Half of this immense amount is said to be wanted by claimants against the Consolidated Traction Company as compensation for the deaths of children or the injuries of older persons.

Judge Warner, of Rochester, N. Y., has made a ruling that is of interest to patrons and also to the officials of street railway companies. In brief, the Judge holds that the conductor of a car has no right to eject from a car a passenger who presents a transfer that has apparently expired, provided that the passenger alleges that the conductor from whom he received the transfer made a mistake in punching the ticket.

The Staten Island, N. Y., Midland Railroad, which recently secured permission to change its motive power to electricity, has been sold by its owners. It is said that the work of construction will be begun within two weeks. The road will retain its present name. The following are the new officers: President, James C. Hinchcliffe, of Paterson; vice-president, Benjamin E. Throop, treasurer and general manager; W. B. Rockwell; secretary, E. G. Wightmann; and electrical engineer, M. J. Wightmann.

TELEPHONE NEWS AND COMMENT.

The telephone line between Richmond and Bristol, Vt., is completed.

An opposition company is said to be after a franchise at Des Moines, Iowa.

A movement is on foot to build a telephone line from Carlton to Hico, Texas.

The Standard Company claims to have secured 500 subscribers in Trenton, N. J.

It is said that the Central Standard Telephone Company, of St. Louis, is not dead, but sleeping.

The New York & New Jersey Telephone Company has established an exchange at East Hampton, L. I.

The Brattleboro, Vt., telephone exchange, which serves 206 subscribers, will have a new switchboard.

The Wausau, Wis., Telephone Company expects to have a 250-station exchange in operation by September 16.

It is probable that the system of the Casco Bay Telephone Company, at Portland, Maine, will not be installed for some time.

The Ohio Valley Telephone Company has begun the construction of a branch line from Shelbyville through Eminence to New Castle.

An opposition company is trying to gain a foothold in Jackson, Mich., with rates of $18 per year for residences and $24 per year for business houses.

The Navy Department, through the Bureau of Yards and Docks, Washington, D. C., is inviting proposals until September 16 for telephones and switchboards.

The new telephone company is not willing to establish an exchange in Jacksonville, Fla., if it is required to bear alone the expense of placing wires underground.

The long-distance lines connecting Louisville, Ky., with the system of the American Telephone & Telegraph Company are expected to be in operation on September 1.

There is a lively competition in the telephone business at Sioux City, Ia., where the Home Telephone Company has entered the lists against the Iowa Union Company.

The New England Telegraph and Telephone Company has been granted permission to put its wires underground from Union Square, Allston, to Lake street, Brighton, Mass.

The work on the new long-distance telephone line from Bowling Green to Franklin, Ky., is being pushed rapidly and will be ready for use in a very short while.

Manager Brett, of the Detroit, Mich., Harrison Telephone Company, says the company will accept the franchise offered it, low rates and all, and disappoint the aldermen.

Auditor Snow, of Oakland, Cal., is about to take steps to enforce the ordinance requiring telegraph and telephone companies to pay a ground rental of $2.50 per pole to the city.

The telephone rate war at Frankfort, Ind., still continues. The Bell company has made another reduction, and business houses now pay $1 per month and private residences 67½ cents.

Officials of the Pennsylvania Railroad are reported to be arranging to equip all cars used on the Chicago limited between New York and Chicago with a telephone in every berth on that train.

It is expected that the Central New York Telephone and Telegraph Company's new building at Syracuse will be finished in about a year. The company now has over 1,200 subscribers in Syracuse.

The Central New York Telephone and Telegraph Company has commenced work on the extension of the metallic circuit from Lowville to Watertown, and expects to have it completed by September 15.

It would be interesting, even if the public were not edified, to learn the reasons upon which the Haverhill aldermen based their refusal to favor an order looking to a burial of wires under ground.—*Salem, Mass., News.*

Stockholders recently took possession of the Citizens' Mutual Telephone plant at Decatur, Ill., by selling $10,000 stock to pay the mortgage claim of John A. Brown. The plant is said to be worth $25,000.

The authorities of the District of Columbia, according to a dispatch from Washington, are determined to make an effort to compel the various companies using overhead wires to remove and place them underground.

The Southern Bell Telephone and Telegraph Company recently notified their patrons in Petersburg, Va., that the price for service would be reduced to $18 per annum for anywhere in the city and $10 per annum for residences.

The Delaware and Atlantic Telephone Company bids fair to have a rival in Norristown, Pa., the Norristown and Philadelphia Telephone Company having signified an intention to erect a line if the consent of council can be obtained.

It is reported that a new telephone company has secured over 1,200 signatures to contracts in Nashville, Tenn. The rates are $3 a month for business houses and $2 a month for residences with a 10 per cent discount for cash in advance.

The Indianapolis, Ind., City Council has passed a sweeping ordinance repealing all franchises to telegraph and telephone lines within the business district of the city. This is a determined stand by the council looking to the placing of all wires underground.

What has become of the new telephone company incorporated sometime ago, and to which the city granted such valuable franchises? Has it gone out of business? This question has been asked before, but no answer has been heard.—*Columbus, O., Press.*

A meeting of the Clarkesville and Feura Bush Telephone Company was held recently at Clarkesville, N. Y. A number of new members were added and it was decided to at once build a line from Clarkesville to New Salem and Voorheesville and thence to New Scotland.

The officers of the Phœnix Telephone Company, of Indianapolis, Ind., are: R. K. Syfers, president; Charles F. Smith (of the Indiana Bicycle Company), vice-president; A. B. Gates, secretary and treasurer; and George W. Stout, Charles A. McCleary, E. M. Churchman and W. N. Gates, directors.

The battle between the Bell and Inter-state Telephone companies is on at Winston, N. C. C. E. McCluer, superintendent of the Southern Division of the Bell company, was in Winston recently and asked for permission to go in the office and see the Inter-state's new switchboard. The request was kindly but emphatically denied.

It is reported that the inspectors and linemen of the New York & New Jersey Telephone Company will be furnished with bicycles so that they may more quickly attend to their duties. The use of bicycles, it is considered by the company, will in the long run save money, as many times horses and carriages are hired to reach the location of trouble on the line.

If Oakland, Cal., will give it a franchise, the Commercial Telephone Company (of Alameda county) offers to pay $50 cash and semi-annually one-half of one per cent of the gross income of the company from rentals and use of telephones and its business within the city during the life of the franchise and in addition agrees to comply with the terms and conditions of the franchise.

Residents of the old Long Island county towns, now the new wards of Brooklyn, N. Y., protest against the determination of the New York and New Jersey Telephone Company to maintain the old telephone rates of 15 cents per call between the city proper and the new wards. The residents of the new wards think there ought to be no such discrimination, now that they are a part of Brooklyn proper.

The Keystone Telephone Company, of Pittsburgh, Pa., dealers in telephone supplies and manufacturers of the Keystone telephone, employ only the most competent electricians and point with pride to the fact that they now have on their books orders for 3,500 telephones. The officers of the company are C. D. Callery, president; Frank R. Liggett, vice-president; Burt Hubbell, secretary and treasurer; and J. G. Ihmsen, manager.

The Chester & Philadelphia Telephone and Telegraph Company is making an effort to get an ordinance through councils to erect poles and wires for the purpose of putting new telephones at Chester, Pa., in competition with the present company. The latter has been petitioned for a 50 per cent reduction in the present rates, but has not given a decided answer to the business men. The new company offers to put telephones in the fire houses and police stations free of charge.

The city of Newark, N. J., has been made defendant in a suit brought in the United States Circuit Court at Trenton by the Police Telephone and Signal Company, of Chicago, charging an infringement of a patent held by the company. The city of Newark was recently supplied with a new police telephone system, which, the plaintiff asserts, was invented by John C. Henry, of Kansas City, who afterward transferred all the rights to them. The system in Newark was put in by another company.

Mayor Braun, of Paterson, N. J., has signed the ordinance giving the New York & New Jersey Telephone Company power to lay conduits and subways for its wires in the streets. With $1,000 in taxes, $1,500 in telephone rentals saved by the stipulation of free service for municipal buildings, and at least $500 franchise fee, the city will gain $3,000 annually by the new arrangement, besides the public benefit caused by the removal of poles and overhead wires. The company must begin the work within three months.

Linemen in the employ of the Southern Massachusetts Telephone Company are at work setting up poles and running lines for a telephone plant on Martha's Vineyard, Mass., which will take in Cottage City, Edgarton, Tisbury and Vineyard Haven. The exchange will be located in the telegraph building at Vineyard Haven, and the plant will be equipped for 60 subscribers, 30 of whom are already assured. Work was commenced a few days ago, immediately after putting in a metallic circuit between Siasconset and Nantucket, Mass.

Taylor's Patent Bookholder for Telephone Directories.

The illustration herewith represents a practical, simple and inexpensive holder, by the use of which telephone directories may be held in open position at the place desired while one is using the instrument, leaving both hands free for taking notes, holding the receiver, etc. It is, of course, obvious that the device may also be employed to hold books, magazines, manuscripts, etc., as may serve one's convenience in reading at any time, the holder being readily adjusted to any angle or any degree of inclination desired. It is manufactured by Messrs. Blake & Johnson, of Waterbury, Conn., has a heavy base to prevent tipping, is nickel-plated, and forms an ornament suitable for any library or office. The standard, of heavy wire, may be either screwed into the base or into a wall, as shown in the separate views, and has a flattened outer portion against which is held, by a thumb-screw, a V-shaped clamp, the inner ends of the arms of which are turned inward to form jaws to grasp the back of the book. Movable with but slight friction through holes in the clamp are wire rods, having bent-over outer ends, adapted to lie out flat to support the book in open position, or to be bent over the edges of the open leaves, as shown, holding the book spread out open at the desired place.

TAYLOR'S PATENT BOOKHOLDER FOR TELEPHONE DIRECTORIES.

A Cable to Honolulu.

Col. Z. S. Spalding has secured from the Hawaiian Government an exclusive franchise and an annual subsidy of $40,000 for laying a cable from San Francisco to Honolulu. Col. Spalding has secured a fully ratified contract with Hawaii, and is ready to apply to the coming session of the United States Congress for needed aid. A general hope is expressed that he may succeed.

KIND WORDS.

"IS O. K."

TO THE EDITOR OF ELECTRICAL REVIEW:

Your paper is O. K. G. T. M.

Fernandina, Fla., August 15.

LITERARY.

The *Inland Printer* for August is an especially interesting number. The cover design is appropriate to the season, the advertising matter is set in perfect taste and the reading columns are filled with things of value to the printing craft.

We have received the proceedings of the eighteenth convention of the National Electric Light Association, held at Cleveland, Ohio, February 19, 20 and 21, 1895. The volume has as a frontispiece a half-tone portrait of President M. Judson Francisco, of Rutland, Vt.

Of the manuscripts left unpublished by Robert Louis Stevenson at his death (not many, by the way), the first to reach the public is a collection of very original "Fables" in the September number of *McClure's Magazine*. One of them is a conversation between John Silver and "Cap'n" Smollett, of "Treasure Island," which is as delicious in its way as anything those worthies do or say in "Treasure Island" itself. In the same number Anthony Hope relates another adventure of the ever-charming Princess Osra, an encounter in the forests of Zenda with an attractive and most courteous highwayman. There is also a romantic tale of court intrigue by Stanley J. Weyman.

Commercial Cable Company's New Building.

The Commercial Cable Company will erect a big office building on the property at 20 and 22 Broad street and 18, 20 and 20½ New street, New York city. The land cost over $1,200,000 and averaged $160 per square foot. The building will have 18 full size stories and a three-story dome. It will be one of the tallest office buildings in New York. The cable company will occupy the first story and the rest of the building will be rented for offices. The architecture will be renaissance and the material will be white marble and buff brick. The building will have a frontage of 50 feet on both Broad and New streets, and an average depth of about 155 feet.

RESPIRATION, SUFFOCATION AND RESUSCITATION.

THE MAIN PHYSIOLOGICAL FACTORS WHICH PLAY THE RÔLE IN RESPIRATION, SUFFOCATION AND RESUSCITATION, AND THE AUTHOR'S METHOD OF PNEUMATIC ARTIFICIAL RESPIRATION.

BY J. MOUNT BLEYER, M.D., F.R.A.M.S. (NAPLES, ITALY), OF NEW YORK CITY. ORIGINAL COMMUNICATION TO THE ACADEMIA DE CIENCIAS MEDICAS, FISICAS Y NATURALES DE LA HABANA, 1895.

Laryngologist to the German West-Side Clinic; Membre de la Societe Francaise de Otologie de Laryngologie et de Rhinologie, Paris; Membre National Academy of Medicine, Mexico; Membre de la Societe Francaise D' Electrotherapie, Paris; Member of the American Medical Association, etc.

(*Continued from page 101.*)

If now we ask, What is respiration? the answer will be this: The function of the lungs or gills by means of which the blood absorbs oxygen and parts with carbonic acid and some other noxious elements. Oxygen is the great inciter of vital changes; its presence is the indispensable condition of life. It is at once fuel and flame; it feeds and it destroys. Constantly withdrawn from the blood by the ceaseless activities of vital change, it is as constantly drawn into the blood by the process of respiration. If the blood rushing through our lungs does not meet there with a supply of oxygen, the torrent carries venous in lieu of arterial blood to the tissues, and the consequence is an arrest of all the vital changes. If in passing through the lungs the blood only meets with a small supply of oxygen, an imperfectly arterialized fluid is carried to the tissues, and a partial arrest takes place, which is seen in the diminished vigor of the organism. All the functions are depressed, and if this depression continues death arrives.

An organism and a medium—these are the two factors in the sum; yet, strangely enough, in trying to solve the problem of respiration, men have principally directed their attention to one factor, the medium, forgetting the equally important influence of the organism. What is that medium? It is an atmospheric ocean 45 miles in depth whirling with our planet while that planet whirls around the sun, subject to incessant fluctuations, yet always preserving the same composition. This atmosphere is chiefly composed of a mechanical mixture of two gases—oxygen, which forms about one-fifth, and nitrogen, which forms nearly the remaining four-fifths. To these must be added $\frac{1}{2000}$ of carbonic acid, with a small quantity of ozone and a definite amount of argon—which is not yet known—and traces of ammonia, etc. Such being the medium, let us now glance at the organism. Here there is nothing constant. Not only are all animals different, but the same organism varies at different periods. As a general fact, the action of the animal organism may be succinctly stated to be the absorption of oxygen from the atmosphere and the exhalation of carbonic acid into it. It matters not whether the animal lives in air or in water—the respiratory medium is always the air—for water deprived of its air or its due proportion of oxygen is as fatal to marine as to terrestrial animals. It matters not by what organ or surface the respiratory exchange takes place, it is always a twofold act of exhalation of carbonic acid on the one hand and of absorption of oxygen on the other. The variety of respiratory organs is great. In the Mollusks we find some kinds having no organs at all, some kinds having gills, others having lungs, and one kind (Oncidium) having both gills and lungs. In the crustacea we find rudimentary gills. In spiders there are both gills and lungs. Fish have only gills. Frogs and salamanders begin with gills, which disappear and give place to lungs. Reptiles, birds and mammals have lungs of different degree of complexity. Cutaneous respiration is effected when the air, either in the water or as atmospheric air, comes in contact with the moist skin in which the blood is circulating. Gill respiration is effected in a similar way; the water rushing over the delicate surface parts with oxygen and takes up carbonic acid. In Pulmonary respiration the air is no longer outside, but inside, the organ; it is drawn in from the atmosphere; the exchange is effected in the organ, and the altered air is then driven out, to be replaced by fresh air.

To understand the mechanism of Pulmonary respirations, let us commence with an examination of the newt (Triton), which presents us with the simplest form of the lung and will, therefore, best enable us to understand the more complex forms. On opening the chest of this newt, recently caught from a neighboring pond, we observe two elongated air sacs of thin membrane; these are the lungs. We remove one sac and find an artery with its ramifications rushing down one side and a vein running up the other. Into this sac the air enters by the windpipe; when there, it is in contact with the delicate blood vessels lying in the membraneous wall; the exchange of gases takes place and the vitiated air is expelled by a contraction of the abdominal muscles, as you may see by observing the live animal in a glass vessel. The reptile's lung is thus an air sac, on the surface of which blood vessels are distributed, and, if we now examine the lung of a man, we shall find that, in spite of its apparently different structure, it is a little more than an almost endless repetition, on a smaller scale, of this very air sac. The windpipe, instead of simply dividing into two branches, each branch terminated by a large air sac, divides and subdivides like the branches and twigs of a tree. These tubes are the *bronchial tubes;* each tubelet terminates in a cell, forming, as Kölliker justly says, the miniature representation of a reptile's lung. The lung of a man is thus an aggregation of bronchial tubelets and air sacs; these air cells are very minute, sometimes the two-hundredths of an inch, occasionally the seventieth of an inch. Between these air cells run the capillary blood vessels. Thus each side of a blood vessel is exposed to the air contained within a cell, and the gases pass to and fro the delicate wall of the cells, and through the walls of the capillaries with perfect facility. So crowded are the blood vessels that the diameter of the meshes formed by their network is less than the three thousandths of an inch, and the number of air cells is calculated at not less than 600,000,000!

With this brief description of the organ, let us pass on to the function. When we breathe, we draw in the air by our nostrils, which penetrate the trachea, or windpipe, thence passing into the bronchial tubes and tubelets, and thence into the air cells. Here it yields part of its oxygen to the blood, receiving carbonic acid in exchange. It was drawn in by a dilatation of the chest, and is driven out again by a contraction of the chest. Science has accurately measured the amount of air thus inspired and expired, namely, about 20 or 25 cubic inches each time. But we never empty our lungs by an expiration; there is always a much larger quantity of air remaining in the air cells, this quantity varying, of

course, with the force of the effort. Herbst found that, while 25 cubic inches was the quantity expelled in ordinary quiet breathing, the quantity would rise to 90 and even 240 cubic inches by energetic efforts. It is therefore calculated that an adult man, with a well developed chest, will retain about 170 cubic inches of air in his lungs, after each respiration, during ordinary breathing; and as 25 inches will be added at the next inspiration, there will be alternately 175 and 200 cubic inches of air acting on the blood which rushes over the vast area of lungs. The phrase "vast area" is no exaggeration; for small as the bulk of those organs truly is, the amount of surface on which blood is exposed to the air in them has been calculated by Lindenau at not less than 2,642 square feet. Is it not wonderful to reflect that, in the course of a single year, 100,000 cubic feet of air have been drawn in and expelled by something like 9,000,000 of separate and complicated actions of breathing to aerate more than 3,500 tons of blood?

The injurious effect of tight lacing has often been pointed out, and in England and America, at least, women have pretty generally learned to see the danger, if not always the hideousness of those wasp-waists once so highly prized. A single fact elicited in the experiments of Herbst will probably have more weight than pages of eloquent exhortation. It is this: The same man who, when naked, was capable of inspiring 190 cubic inches at a breath, could only inspire 130 when dressed. Now, if we compare the tightness of a man's dress, we shall easily form a conception of the serious obstacle stays must be to efficient breathing; and the injurious effect of this insufficient breathing consists, as we shall see hereafter, in its inducing a depression of all the vital functions. In respiration we draw in and give out a *similar quantity* of air, but this air is by no means of *similar quality*. It has been altered — vitiated. The ancients had no other notion of respiration than that it served to cool the blood, as the air cools the heated brow. We know that it serves to supply the indispensable conditions of vital changes by removing carbonic acid from the blood, and supplying its place with oxygen. This air which is expired differs profoundly from that which was inspired; it has lost much of its oxygen, and has gained from three to six per cent of carbonic acid, a large amount of vapor, traces of ammonia, hydrogen, and volatile organic substances, with an increase of heat. It was pure, respirable air when it entered, and is now so vitiated that after a few repetitions of the process it becomes irrespirable. The vitiation results from the carbonic acid. The quantity of this gas which is momently thrown into the atmosphere by each individual, varies accordingly to sex, age, physical and mental condition, and according to the season of the year and time of day. We are constantly exhaling carbonic acid, but not in constant quantities; men exhale much more than women; during the ages of from 16 to 40 the quantities exhaled by men are nearly double that exhaled by women of the same ages. In men it is observed that the amount gradually increases from the age of eight to that of 30, making a sudden start at the age of puberty. From the age of 30 it decreases gradually, till at extreme old age the amount is no greater than it was at 10. In women a noticeable phenomenon is observed; the amount increases from infancy to puberty, just as in men; but at that epoch the increase suddenly ceases, and remains stationary till the change of life, when the amount increases. Besides such variations depending on age and sex, there are others dependent on the muscular activity and physical condition of the individual. The amount of carbonic acid exhaled during digestion is greater than that exhaled during fast, and greater in sunlight than in darkness. Wines, spirits, tea, coffee and narcotics lessen the amount; not, however, because they interfere with the process of respiration, but because they cause less carbonic acid to be produced by the organism—they protect the tissues from the destructive action of oxygen.

The carbonic acid thus thrown into the air is the product of disintegrated tissues—the ashes of the vital flame. The blood in the capillaries parts with its oxygen received in the lungs, and, according to the current hypothesis takes up in exchange the carbonic acid produced by the action of the tissues. If we were permitted to designate every interchange of these gases by the name of respiration, we should have to speak of two different kinds of respiration; one taking place in the lungs, where carbonic acid is exchanged for oxygen, the other taking place in the tissues, where oxygen is exchanged for carbonic acid; but a more accurate and philosophical nomenclature, which seeks its terms in a consideration of functions, and not in the results effected by those functions, will not permit such confusion.

The exchange of these gases, considered simply as an exchange, is a physical fact resting on well-known physical laws. There have been, and there still are, disputes as to whether the gases are free in the blood, as in water, or are in a state of slight chemical combination; but the facility with which the exchange is made seems to be as great as if they were free. If blood be shaken in a vessel containing air, it will absorb more than a tenth of its volume of oxygen from that air. It is then saturated, and if now poured into a vessel containing carbonic acid, and there shaken, it will abandon almost all its oxygen and absorb carbonic acid. This is a simple illustration of the interchange effected in the lungs and in the tissues; for, as previously indicated, the delicate walls of the blood vessels oppose no obstacle in this interchange. It is only necessary that the blood should be brought in contact with an atmosphere, or a fluid, of a composition specifically different from its own. In the lungs, the carbonized venous blood comes in contact with air containing scarcely any carbonic acid. In the tissues oxygenized arterial blood comes in contact with a plasma which contains scarcely any oxygen; and in both cases the blood yields up its own gas in exchange for another. In the normal process the exchange is always that of *these* gases; but to prove the simple physical nature of the exchange, we have only to substitute hydrogen for oxygen, and the animal confined in a vessel containing this gas will be found to exhale carbonic acid with the same facility as when atmospheric air is breathed. No animal can continue long to breathe hydrogen, simply because that gas does not furnish the conditions of vitality; but while the animal breathes in hydrogen, the exhalation of carbonic acid is as perfect as at any other time, thus showing that the exhalation depends on the difference in the nature of the gases in the atmosphere and in the blood.

When we breathe over and over again the same air, we gradually vitiate it by the constant exhalation of carbonic acid, which gradually brings the air up to the point where the difference between it and the blood—and as regards the proportion of carbonic acid—disappears. The blood ceases to be arterialized, and the vital functions are arrested. In vain does the air still contain a quantity of life-giving oxygen; the blood cannot take it up, because it cannot get rid of the carbonic acid, and it cannot get rid of its carbonic acid because the conditions of the exchange are absent. To make an animal breathe air overcharged with carbonic acid is equivalent to a gradual prevention of his breathing at all. Suffocation results from vitiated air in precisely the same manner as from interception of the air. Although burking and gagging are crimes which appall the public, that public seems almost indifferent to the milder form of the same murder when it is called "want of ventilation." In spite of the historical infamy of the Black Hole at Calcutta, our prisons, hospitals, theaters, churches and other public buildings were left disgracefully neglected, until, thanks to the energetic labors of our sanitary reformers, public attention was aroused. That thousands have been the victims of public ignorance on this important matter may be shown by a single example. The deaths of new-born infants between the ages of one and 15 days, which in the Dublin Lying-in Hospital amounted in the course of four years to 2,944 out of 7,650 births, were suddenly reduced to only 279 deaths during the same period, after a new system of ventilation had been adopted. Thus, more than 2,500 deaths, or one in every three births, must be attributed to the bad ventilation. Since the last 15 years much change has taken place regarding the system of ventilation in our public institutions and private dwellings. In Europe and America the public is daily becoming more enlightened on the subject of ventilation, although a dangerous indifference, springing from want of elementary knowledge, is still prevalent, and taxes the patience of reformers; but in the country, where these lines are written, it is painful to observe that even highly cultivated men seem almost insensible to the importance of fresh air. Many in our over-crowded districts sit for hours in low-crowded rooms, so dense with tobacco smoke that on entering you cannot recognize your friends; and so vitiated is the atmosphere by the compound of breath, bad tobacco, human exhalations and an iron stove, that at first it seems impossible for you to breathe in it. Even in their private rooms they breathe a hot, musty, dry air, which makes one gasp for an open window. It is true that after a while you get accustomed to the air. You also get accustomed to that of the smoke-filled rooms with people and other conditions. On entering, you felt it would be impossible to stay there 10 minutes; but in less than 10 minutes it has become quite tolerable, and in half an hour scarcely appreciable. If you quit the room for a few minutes and return once more after having breathed fresh air, again you perceive the poisonous condition of the atmosphere, but again you will get accustomed to it, and seem to breathe freely in it. Was this atmosphere really not injurious? or have your sensations, like sentinels asleep, ceased to warn you of your danger? To answer this we will first bring forward some experiments instituted by Claude Bernard, on the influence of vitiated air. A sparrow left in a bell-glass to breathe over and over again the same air, will live in it for upwards of three hours; but at the close of the second hour—when there is consequently still air of sufficient purity to permit this sparrow's breathing it for more than an hour longer—if a fresh and vigorous sparrow be introduced, it will expire almost immediately. The air which would suffice for the respiration of one sparrow suffocates another. Nay, more; if the sparrow be taken from the glass at the close of the third hour, when very feeble, it may be restored to activity; and no sooner has it recovered sufficient vigor to fly about again, than, if once more introduced into the atmosphere from which it was taken, it will perish immediately. Another experiment points to a similar result. A sparrow is confined in a bell-glass, and at the end of about an hour and a half it is still alive, although obviously suffering; a second sparrow is introduced; in about 10 minutes the new-comer is dead, while the original occupant flies about the lecture-room as soon as liberated.

(To be continued.)

Electric Power for Mining in Australia.

The cable reports that very extensive undertakings in the introduction of electricity for power purposes in Western Australia have been set afoot, and adds that the English firm of Rothschilds is interested, says the New York *Evening Sun*. This great house has already become quite the leading operator in gold mining in the world. Commanding, as it does, the services of some of the most capable of American gold mining engineers, its undertakings hitherto have given a grand result. There is nothing inherently improbable, therefore, in the report that the house's operations are about to extend to the new gold fields of Western Australia.

These interesting fields were discovered only two years ago. Under singular disadvantages in respect of fuel, timber and transportation, their output last year reached nearly $4,000,000, and is expected this year to reach double that amount. Apparently the electric power project referred to is one to generate electricity at some point where fuel is cheap and transmit it as power to the mines.

At present it is difficult to assign a limit to the possibilities of development in the gold fields, as new discoveries are even now continually being made. If the project for giving them electrical power proves economical, the natural effect would be to stimulate prospecting. The prospects of Western Australia are not wholly without interest for the United States. Two years ago a few hundred thousand feet of Pacific Coast pine and fir lumber were shipped to South Africa, but now several steamships are engaged in the traffic, carrying from 2,000,000 to 2,500,000 feet each. This timber is used in the mines, and a similar demand may spring up from the Murchison and Coolgardie fields.

Jaeger Electric Lamp Company Sold Out.

Deputy Sheriff Dunphy on August 19 sold out the effects of the Jaeger Electric Lamp Company, at 154 West Twenty-seventh street, New York city, which was incorporated on February 21 last under New Jersey laws with a capital stock of $10,000.

DAILY INSULATION TESTING OF TELEGRAPH LINES.

READ BEFORE THE INSTITUTION OF ELECTRICAL ENGINEERS BY W. H. PREECE, C.B., F.R.S., ETC.

In a telegraph system so extensive as that which is now maintained by the British Post Office the existence of an accurate method of determining the insulation resistance of the wires each morning is essential. While the public service demands that the 160,000 miles of open wire and 28,500 miles of underground and submarine conductors comprised in the system shall be ready for the dispatch of messages to every portion of the kingdom at any hour, it is necessary, for purposes of maintenance and of comparison, that all the wires on a particular route may be tested about the same time. In a climate so variable as ours an hour may produce a considerable difference in the insulation resistance of a suspended wire, owing to an increase or decrease in the amount of moisture in the air. Hence the operation must be as rapid as possible.

It is inconvenient, and almost impracticable, to test the open lines in short lengths—lengths of 10 miles or less—so as to admit of direct estimation of the insulation resistance, by disconnecting one end of these short lengths. The tests must be made in sections of an average length of about 50 miles. Even with this distance between the testing offices, and the elimination of all short circuits worked by key duplex (which may be considered to be under a constant test), the number of sections requiring a practically simultaneous test is at present about 1,500.

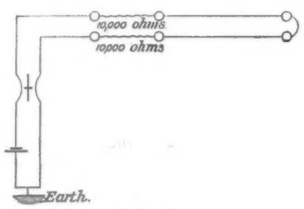


FIG. 1.

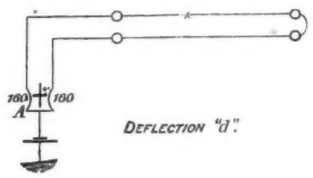


FIG. 2.

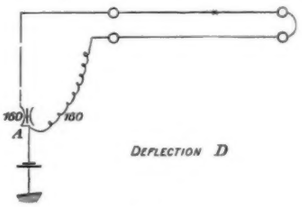


FIG. 3.

It is also necessary that this daily test shall secure a fair amount of accuracy. For some time these tests were made by sending a current from a known voltage from one office, and receiving it at the next testing office, on a tangent galvanometer of carefully estimated sensitiveness. To avoid errors due to inequality in the insulation resistance at different portions of the line, a resistance approximately 10 times the conductor resistance of the wire under test was inserted in the path of the current at each end of the wire, and tables were supplied showing the mean insulation resistance corresponding to any given received-current reading.

A difference in the conductor resistance of two wires on the same poles would frequently produce as much difference in the received-current reading on the two wires as would be produced by a small covered work fault. Moreover, the personal equation of the two observers and inaccuracies in the standards of force and current, introduced elements of doubt and caused unnecessary verification tests, which occupied valuable time.

The method finally adopted possesses, I believe, sufficient novelty to warrant my introducing it to the notice of this institution.

It does away with the errors previously introduced by small differences in the "constants" at the testing offices; it reduces the number of tests to one-half and it facilitates the exact localization of special faults.

Each morning the minor testing office loops the wires in pairs for a certain number of minutes.

A differentially wound tangent galvanometer, and a carefully estimated electro-motive force of a little over 55½ volts, is employed at the principal testing office. The positive pole of the testing battery is put to "earth," and a current is sent from the negative pole of the battery through one of the galvanometer coils and a resistance of 10,000 ohms, thence through the looped wire, a second resistance of 10,000 ohms, and the other coil of the tangent galvanometer to earth (Fig. 1).

As the current sent and that received are passed through the galvanometer coils so as to exert a deflective force on the needle in opposite directions, it is clear that, in the event of the insulation being infinite, the galvanometer needle will stand at zero, while any difference between the sent and received currents will indicate the exact amount of leakage at the insulators, the mean value of which in insulation resistance is found by reference to tables supplied for the purpose.

Any considerable difference between the observed leakages on the various loops, on the same route, on the same day, or any small difference existing for two or more days, is carefully localized, and, as the wires are already looped, the usual Wheatstone bridge test for the exact distance of the fault can be promptly applied.

It will be understood that in fine weather the effects of even small covered work faults are at once seen by comparison with the readings obtained on other similar loops. The deflection observed is wholly due to leakage and may double the galvanometer reading, under circumstances that, with the original received-current test, would have only produced a difference of two per cent in the observed received-current reading—a fact the importance of which will be recognized when it is stated that a few seconds only can be devoted to this preliminary test of each section. But comparison between the various loops is not the only means which the testing office has at its disposal for the rapid estimation of the condition of the wires.

A testing office whose bridge may not be at once available can, by changing the position of their testing switch so as to use the galvanometer differently, instantaneously estimate the difference in tangent divisions between the leakage on the two wires composing the loop (Fig. 2); and the value in tangent divisions of the loss on the wire showing the heavier leakage can also be estimated (Fig. 3).

If the extra leakage is caused by a definite fault its distance in ohms can be estimated, with sufficient accuracy for practical purposes, from the readings obtained and the known mean conductor resistance of the section tested.*

Besides this "maintenance standard," the testing office is supplied with another standard deflection for each section, which requires a little explanation.

Of the various methods of signaling which are employed on the Post Office lines, including key duplex, quadruplex, multiplex, and even telephonic communication, none require a higher comparative insulation resistance than the Wheatstone automatic high-speed system, whether worked as simplex or as duplex. With this system, condensing compensation for the electro-magnetic inertia and self-induction of the line and apparatus is required; and, although the speed with high insulation resistance is inversely as the K R of the circuit, a careful series of experiments has demonstrated that our lines will not give the full speed value to be obtained with any given K R, and with our present form of apparatus, if the absolute insulation resistance falls below the total conductor resistance of the circuit concerned.

As this obviously means that the mileage insulation resistance must increase as the square of the length of the circuit, the required absolute insulation resistance of two sections tested between the same points, but normally used on circuits of different lengths and resistances, would differ very greatly. The deflection equivalent to this particular insulation is called the "working standard," and indicates the leakage level below which the wire becomes more or less unsuited to our most exacting requirement, namely, automatic high-speed working.

The testing officer has, therefore, a timely warning as to the rearrangement of sections which is necessary to insure the required insulation resistance for the more important wires.

Circuits used for hand signaling only are workable at a much lower insulation level than that which is necessary for high-speed working, while telephonic loop circuits are capable of being used efficiently when the mileage insulation resistance is very low, if the difference between the insulation resistance of the two wires is not great.

A few of our 200-mile circuits still contain a considerable proportion of old high-resistance iron wire, and as the necessary mileage insulation resistance for high-speed working in these cases exceeds a megohm per mile, it will be seen how important it is to the Post Office to use wires of low resistance.

Indeed, the difference between the recorded deflections corresponding to the minimum maintenance standard, and those corresponding to the working standard, at once indicate the particular circuits which require to be reduced in conductor resistance when renewals are in progress.

This system has been designed and established by Mr. A. Eden, one of the technical officers of the Post Office; and it may be said that the method of test is not only rapid and reliable, but the permanent particulars supplied for each section furnish a complete index to the actual condition and capabilities of the circuit.

* $\frac{\text{Total loop R} \times \text{D}}{2\,\text{D} - d} - 160 =$ distance of fault from A.

OBITUARY.

J. De Witt Congdon, for 20 years night manager for the Western Union Telegraph Company in Chicago, with jurisdiction from there to the Pacific Coast, died in that city on August 16 from an apoplectic stroke.

Jason M. Bowen, who was killed recently by the accidental discharge of his gun at his Summer home on Contentment Island, near South Norwalk, Conn., was for many years prominent in New York business circles and was president of the Portland, Conn., Electric Light Company.

D. W. Kissam, for many years secretary of the Bridgeport Brass Company, died suddenly at Bridgeport, Conn., on August 22 of apoplexy. He ordered his horses harnessed and took a seat in the carriage with his daughter. As he leaned forward to pick up the reins he expired. Mr. Kissam leaves a large estate.

PERSONAL.

H. Marechal, chief engineer of the city of Paris, France, is visiting the United States to inspect our methods of electrical propulsion.

Mr. J. H. Vail has been appointed as consulting electrical and mechanical engineer by the State Mutual Life Assurance Company, Worcester, Mass., and is now preparing plans and specifications for a complete steam and electric plant of the best type for the service required.

ADVANCE INFORMATION.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies, new telephone companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week.

New Electric Railways.

NEW ORLEANS, LA.—The Hudson Street Railroad franchises, numbering six lines and covering the entire city, were sold for $10,000, the bidder being James J. McLoughlin.

FREDERICK CITY, MD.—It is understood that the people of Brunswick, Md., are contemplating making a bid for the construction of an electric road from Middletown to that place by way of Broad Run, Burkettsville and Petersville.

GARDENVILLE, N. Y.—The new electric road which is to run from Buffalo to Gardenville and Ebenezer will be completed by the first of October. Charles and George Busch have been awarded the contract for building the same.

BELVIDERE, ILL.—This place may have an electric street car line. J. B. Canterburry, of La Crosse, Wis., is interested.

NEW YORK, N. Y.—It has been decided to equip a portion of the Fourth avenue cars with storage batteries. Work to be begun October 1.

CORUNNA, MICH.—The Owosso & Corunna Street Railway, with all its appurtenances, was sold at auction recently to Alexander Ralph, of Philadelphia, for $5,000.

KANSAS CITY, MO.—An addition of two stories, to cost between $10,000 and $12,000, will be made to the office building of the Metropolitan Street Railway Company at Fifteenth and Grand streets.

INDIANAPOLIS, IND.—Work on the Clodfelter electric line between this place and Marion has been suspended, and it is rumored at Marion that Mr. Clodfelter has retired. There is also a rumor that a new company is forming, headed by Congressman Tom Johnson, of Cleveland.

BALTIMORE, IND.—The contract for the building of the roadbed of the Columbian & Maryland Electric Railway, which will connect Baltimore and Washington over a 36-mile route, has been awarded to E. D. Smith & Son, of Philadelphia. The cost of construction, including a branch to Ellicott City, will be about $3,000,000.

BUFFALO, N. Y.—The contract for building the Buffalo, Gardenville & Ebenezer Electric Road was let to Charles T. and George M. Busch.

ALLENTOWN, PA.—Negotiations are now pending for the purchase of all the electric railway lines in this vicinity by the new Allentown & Reading Electric Railway Company, Pa., so as to bring all under one control.

CANTON, OHIO.—A. A. Hoover, of New Berlin; Lew Smith, of Greentown; Milo White, of Springfield, and M. Nees, of Uniontown, have incorporated a company to build a street railway from Canton to Akron. The enterprise is backed by W. A. Lynch, of Canton, president of the Local Street Railway Company, and the Canton & Masillon Inter-Urban line.

PORTCHESTER, N. Y.—The Portchester, Rye, Harrison & White Plains Electric Railway Company has been incorporated by John W. Lounsbury, William Ryan, of Portchester; John Duffy, of White Plains; Ebenezer Bull, of Harrison; Charles B. Haines, of Kinderhook, and others. Capital stock, $150,000.

DANVILLE, ILL.—The Danville & Northwestern Electric Railway Company has been incorporated by W. W. Hatch, of New York, and citizens of Danville, to construct a railroad from Danville, Ill., to Gilman, Ill.

HARTFORD CITY, CONN.—Chicago capitalists are contemplating constructing an electric street railway between Montpelier and Hartford City.

FRANKLIN, N. H.—Ex-Congressman Warren F. Daniels is at the head of a syndicate which has been formed for the purpose of constructing and operating an electric street railroad in this city.

HARTFORD, CONN.—The Central Railway and Electric Company are constructing an electric line to Hartford.

PROVIDENCE, R. I.—A party of New Bedford railroad officials will construct trolley to connect Providence with Fall River and New Bedford.

BROOKLINE, MASS.—The Boston & Albany Railroad are considering the question of applying electricity.

SPRINGFIELD, MASS.—The Athol & Orange Electric Road has passed into the hands of its new owners, who have elected the following officers: Mr. Ferguson, president; W. D. Lucy, clerk and treasurer, and the remainder as directors. Capital stock, $60,000.

MARION, IND.—An electric railway is being contemplated from the gas belt at Marion to Chicago. It would be the longest electric railway in existence.

COLUMBIA, S. C.—The Columbia Telephone Company has been incorporated by W. Y. Abrahams, W. B. Lowrance, F. D. Kendall, A. R. Stewart, R. G. Johnstone, T. J. Harper and J. B. Friday. Capital stock, $5,000.

WESTMINSTER, MD.—The Westminster & Union Mills Electric Company has elected T. H. Shriver, president, and Charles H. Vanderford, treasurer. This company will build an electric line between Westminster and Union Mills.

FOREST GLEN, MD.—Benjamin F. Leighton and others are endeavoring to organize a company to build an electric line from Washington to Woodside, Linden and Forest Glen.

NEVADA, MO.—The Nevada Electric Light Company has bought franchise to operate a street railway in Nevada.

BOSTON, MASS.—The Mystic Valley Electric Street Railway, with a capital stock of $65,000, is building an electric road to run from Central Square, Stoneham, to the center of Winchester, and from there to Massachusetts avenue, in the center of Arlington.

HAVERHILL, MASS.—The Haverhill, Georgetown & Danvers Street Railway held a meeting recently and elected H. L. Perkins, clerk. Subscriptions to the amount of $50,000 have been raised, and $30,000 more are promised.

KOKOMO, IND.—Kokomo & Greentown Street Railway Company has been incorporated by W. E. Snow, A. Avery, C. H. Hilton, J. S. McDonald, all of Detroit; F. H. Allen, of Kokomo. Capital stock, $50,000.

BLUFFTON, CONN.—It is reported that an electric railroad will be built from Bluffton to Camden.

MARION, IND.—The Indianapolis, Anderson & Marion Electric Company have filed bond in the sum of $5,000 to hold franchise to construct their road.

DANVILLE, ILL.—An electric railroad to run from this place to Gillman, with two important branches, has been incorporated.

RICHWOOD, OHIO.—There is talk of an electric railway from this place to Columbus, *via* this city.

NEW YORK, N. Y.—The Portchester, Rye, Harrison & White Plains Electric Railroad Company to construct a street railroad in the towns named has been incorporated. Capital, $150,000.

FOLLETS, IOWA.—It is understood that an electric railway is to be built from this place to Elvira.

SAN JACINTO, TEX.—San Jacinto & North Texas Railway Company has been incorporated. Incorporators, W. E. Davis, of Boston, Mass.; E. J. Minnock, Hayes Hongee, M. S. Cooper and W. P. McComb, of Montgomery County, Tex.; A. S. Hall, of Houston; W. W. Levy, of Galveston, and E. L. Smith, G. I. Owmley and B. F. Ellis, of San Jacinto. Capital stock, $200,000.

KAWEAH, CAL.—Kaweah Irrigation and Power Company has been incorporated. The directors: Elisha C. Ware, Chicago, Ill.; A. G. Wishon, Tulare; George Hanna and John A. Pirtle, of Los Angeles, and O. C. Ainsworth, of Pasadena. The amount of the capital stock is $300,000.

SHENANDOAH, PA.—This place and Ringtown are to be connected by an electric railway.

OSHKOSH, WIS.—Work on the Tillotson Electric Street Railway line will be resumed, a loan of $450,000 having been secured in New York.

SAN BERNARDINO, CAL.—The Southern California motor road has been sold to the Pacific Improvement Company for $167,100.

BRATTLEBORO, VT.—The stockholders of the Brattleboro Electric road are speculating upon plans for the extension of their line to Hinsdale and thence to Northfield, Mass.

PONTIAC, MICH.—Pontiac & Sylvan Railway Company has been incorporated by H. B. Mills, Thaddeus H. Smith and William J. Hinman. Capital stock, $50,000.

DANVILLE, ILL.—Danville & Northwestern Electric Railway Company has been incorporated by W. T. Cunningham, John W. Dale, William P. Chandler and others. Capital stock, $100,000.

KNOXVILLE, TENN.—The Knoxville Electric Street Railway Company will expend $50,000 in reconstructing its system.

GRAHAM, VA.—The Graham-Bluefield Electric Railway Company, in which A. St. Clair, D. E. Johnston, T. H. Graham and others are interested, are contemplating constructing a $50,000 electric railway.

LITTLE ROCK, ARK.—The Boulevard Street Railway Company, of which J. H. Healey is manager, has been granted franchise to construct a line.

WASHINGTON, D. C.—The Metropolitan Railway Company, of which A. N. Connett is engineer, will rebuild 13 miles of its F street line for the underground electric conduit system now in use on its Ninth street line.

WASHINGTON, D. C.—A. E. Randle, 631 Pennsylvania avenue, N. W., is having estimates made for the construction of an electric railway to Congress Heights.

ANGELICA, N. Y.—There is talk of a trolley road from this place to Belfast, the power to run the dynamos to be furnished at Angelica.

DEDHAM, MASS.—The Norfolk Suburban Street Railway Company have petitioned the Dedham selectmen for the right to construct and operate its track from the junction of Washington and William streets, through Washington street to the Boston line.

AUBURN, N. Y.—Auburn Inter-Urban Electric Railway Company has been incorporated by Daniel L. Ramsay, Samuel E. Bell, George W. Elliott and others.

SPARTANBURG, S. C.—George O. Tenny, contractor, has begun the work of the electric line from Spartanburg to Glendale.

LEBANON, MO.—R. S. Scott and Hamilton White, of Des Moines, Iowa, will organize a company to build the proposed electric road from Lebanon to Bagnell, a distance of 75 miles.

NIAGARA FALLS, N. Y.—The Niagara Electric Company has made an official proposition to the towns of Galen, Rose and Huron, to build an electric road from Clyde to Bonnicastle, the Summer resort on Sodus Bay. The company request the towns to pledge $10,000.

HOMESTEAD, PA.—Erbeck Brothers, contractors, of this place, were awarded the contract for the construction of the extension of the Homestead and Highland street railway line from Homestead to Duquesne.

WASHINGTON, D. C.—The consolidation of the Washington & Georgetown Cable Street Railroad Company with the Chevy Chase Electric Line Company is reported to have been practically accomplished and that there will be a reorganization under the name of the Capital Traction Company, with a capital stock of $10,000,000.

DEDHAM, MASS.—A new electric railroad is to be built from Dedham to Walpole by way of Norwood, to be known as the Norfolk County Electric Street Railway. A meeting was recently held to arrange articles of incorporation.

GREENFIELD, MASS.—An electric railroad is to be constructed.

PORTLAND, ME.—Work is about to commence on the construction of an electric road from Cape Elizabeth to Rigby Park.

PORTLAND, ME.—An electric road is to be constructed from Old Orchard to Kennebunkport.

HAVERHILL, MASS.—The Haverhill & Danvers Electric Street Railway will probably be constructed. It is now in the hands of a street railroad syndicate.

MOUNDSVILLE, W. VA.—B. F. Peabody, of Benwood, is president of the electric line which has recently been completed between Benwood and Moundsville.

FALL RIVER, MASS.—The Fall River Street Railway Company, at meeting of stockholders, held recently, elected the following officers: President, Wendell E. Turner; treasurer, John T. Robertson; clerk of corporation, James F. Jackson. The work of constructing the road will begin by the middle of next month.

MILWAUKEE, WIS.—Still another extension of the suburban electric street railway system is proposed.

YOUNGSTOWN, OHIO.—The contract has been let for the construction of an electric railway from this place to North Lima.

DAYTON, OHIO.—Wayne Avenue Street Railroad is to be electrically equipped.

Electric Light and Power.

HUBBARD, WIS.—It is proposed to bond this town for $8,000 and establish an electric light plant.

MILACA, MINN.—The village has voted to bond itself to put in electric lights and waterworks.

KERVILLE, TEX.—A movement is on foot to have the town lighted by electricity, and parties are here having in view the erecting of an electric plant and ice factory.

GEORGETOWN, S. C.—An electric light plant will be erected this season.

DUBUQUE, IA.—The electric light plant is adding modern machinery to its plant.

CHICAGO, ILL.—Hinsdale electric light works has been incorporated; capital stock, $2,000. Incorporators: Henry L. Gardner, Frank E. Bradley and Arthur M. Morgan.

NEVADA, MO.—A franchise has been granted for electric lights here.

MORRISTOWN, TENN.—The Morristown electric light plant has been sold at auction to the General Electric Company for $4,000. The company will add new machinery and otherwise improve the service.

HONAPATH, S. C.—W. C. Whitner, of Anderson, can give information concerning Ware's Shoals, of which the owners intend to develop the water-power and transmit it by electricity.

WEATHERFORD, TEX.—The city of Weatherford Water, Light and Ice Company has been incorporated by P. V. Bryan, W. P. Anderson, G. A. Holland and W. T. Hudgcins with a capital stock of $80,000.

HOT SPRINGS, ARK.—The Ouachita Power Company has been incorporated by I. C. Hunsicker, of Reading, Pa.; R. Murray, J. J. Walker and J. B. Higdon, of Hot Springs, to manufacture electricity, etc. Capital stock, $200,000.

LYNDONVILLE, VT.—Steps are being taken to establish an electric light plant.

GOOSE ROCKS, ME.—Steps are being taken to establish an electric light plant.

ST. JOHNSBURY, VT.—The Island Pond Electric Light and Power Company has been incorporated. Electric lights will soon be put in at Island Pond.

MEDFORD, MASS.—The International Lard and Oil Refining Company, of New York, proposes to erect a factory of four stories; also an electric plant and operatives' houses, the whole to cost about $400,000.

PINE PLAINS, N. Y.—The Pine Plains Light Company has been incorporated to supply gas and electricity in Pine Plains, Dutchess County, and suburbs. Capital, $10,000. Directors, John R. Thompson and Newton Hebard, of Amenia; Frank Eno, Frederick Bostwick, J. H. Bostwick, W. Bostwick and Charles S. Wilbur, of Pine Plains.

SCOTT HAVEN, PA.—The Youghiogheny Coal Company has added a new electric light plant to its works.

PALERMO, N. H.—The Maine Water and Electric Power Company proposes to improve the Sheepscot Valley water power. C. P. Collins, of Bradford Centre, Pa., is president and William Doe, of Duke Centre, Pa., general manager.

UNIONTOWN, GA. — This place is to be lighted by electricity. A company is now being organized.

MILFORD, MASS. — The electric lighting company is preparing to put in two 200 horse-power boilers to enlarge the capacity of the lighting plant. It is reported that the company will soon extend their wires to mills in the town of Norfolk and perhaps to the center village.

SPRINGFIELD, MASS.—The Springfield Electric Light Company will erect a $150,000 plant at Indian Orchard and send 1,800 horse-power to the city produced by water-power.

UNIONTOWN, ALA.—A company is being organized to secure an electric light plant.

ST. AUGUSTINE, FLA.—T. J. Appleyard, of Sanford, Fla., and E. M. Hammond, of Orlando, are interested in a company which will place an electric light system in the city.

CHATTANOOGA, TENN.—C. C. Shelton & Company contemplate erecting an electric light plant in their flour mill.

FRIENDSHIP, N. Y.—Messrs. Hellar & Wellman are making preparations to at once start the electric plant here.

AMITYVILLE, L. I.—Active steps are being taken with the view to the establishment of an electric plant here.

ALBUQUERQUE, N. M.—The electric light company of Albuquerque reported to have recorded deed of trust for $100,000.

EASTPORT, ME.—Eastport Gas and Electric Company reported notice of sale under foreclosure.

FRANKLIN, MASS.—The electric lighting company will put in new machinery to enlarge the capacity of the lighting plant. The company will probably extend its wires to mills in the town of Norfolk and perhaps to the center village.

DELAVAN, WIS.—The Delavan Light and Fuel Company has been incorporated by A. N. Kendrick, E. P. Williams and others with a capital stock of $16,000.

NANAIMO, B. C.—Joseph Hunter electric light works reported bill of sale for $55,000.

REED CITY, MICH.—Reed City Electric Light and Power Company reported as having renewed chattle mortgage for $500.

CHARLESTON, W. VA.—A New York syndicate is reported to be contemplating the utilization of power from the Kanawha Falls for electric light and power.

SIDELL, IND.—This place will soon be lighted by electricity.

NEWBURGH, N. Y.—Newburgh's electric light companies, which have been consolidated, now have a capital of $250,000.

FLUSHING, L. I.—Citizens of this place are agitating the question of better lights. A strong effort will be made to have the village lit by electricity instead of gas as at present.

PHILADELPHIA, PA.—Francis Brothers & Jollett, incorporated, have taken out a permit to put boilers, engines, dynamos, etc., a complete equipment for heating, ventilating, and electric light plant for Horticultural Hall, which is in course of construction on Broad street, below Locust. The work will cost $25,000.

BLOOMSVILLE, OHIO.—Citizens of this place want waterworks and an electric light plant.

SPRINGFIELD, MASS.—The United Electric Light Company of this place is to build a new power house at Indian Orchard at once.

SHELBURNE FALLS, MASS.—An electric light plant will probably be established.

MARBLE FALLS, TEX.—The Marble Falls Land and Power Company has been incorporated by John H. Barrett and others. Capital stock, $100,000.

BROOKHAVEN, MISS.—The Brookhaven Manufacturing and Improvement Company will erect a complete electric light plant.

New Telephone and Telegraph Companies.

WAUSAU, WIS.—The Wausau Telephone Company is putting in a new system at this place.

OBERLIN, OHIO.—Postal Telegraph Company has been incorporated. Incorporators are F. P. Hill, Thad. Rowland, W. B. Bedortha, Jno. W. Steele and C. W. Rowland. The capital is $50,000.

NEW ALBANY, IND.—There is talk of organizing a company to construct a telephone line between this city and Salem.

CLEBURNE, TEX.—A telephone exchange is to be established here.

GEORGETOWN, KY.—The American Telegraph and Telephone Company has been granted the privilege of operating a long-distance telephone in this city. The line will be built through here from Frankfort, where it connects with Louisville.

CAMP KNOX, KY.—A telephone line will soon be run from this place to Milltown, and thence to Greensburg.

LEWISBURGH, PA.—Home Telephone Company has been incorporated. Capital, $10,000.

HUNTINGTON, IND.—Chas. F. S. Neal, Chancellor Commander of the K. of P., of Indiana; Charles N. Zion and Phil Alder, of Lebanon, have purchased the Phœnix Telephone Exchange of this city.

SAUGATUCK, MICH.—Articles of incorporation have been filed for the Saugatuck & Gauges Telephone Company. The incorporators are E. E. Brunson, Fred. Wade, H. H. Hutchins, Charles E. Bird and H. Bird, Jr. The capital stock is $10,000.

GALESVILLE, WIS.—The Galesville-Winona telephone line will be extended to Ettrick at an early date.

RICHMOND, VA.—A charter has been granted to the Richmond Standard Telephone Company. Capital stock shall not be less than $100,000 nor more than $300,000. Officers, John C. Robertson, of Chesterfield County, president; R. H. Smith, of Richmond, secretary and treasurer. Directors, A. B. Guigon and Thomas R. Marshall, of Richmond; James F. Bradley, of Manchester, and George W. Cross, of New York.

BROCKTON, MASS.—The Southeastern Telephone Company have been granted permission to construct underground wire conduit.

ELIZABETH, N. J.—Articles of incorporation of the Ohio Automatic Telephone and Switch Company have been filed; capital, $250,000. The incorporators are Colonel William C. Fogg and William S. Thyng, of Roselle; John W. Lovell, of New York, and Louis H. Allen, of Roselle. The company will manufacture the Stronger automatic telephone switch.

OXFORD, PA.—Octoraro Telephone and Telegraph Company, to operate in Chester, Lancaster and York Counties; capital, $5,000. S. R. Dickey, president; E. L. McSparran, vice president; Eli L. McKissick, secretary and treasurer.

LONGVIEW, TEX.—The Western Union Telegraph Company are having another wire built between this place and Dallas.

New Manufacturing Companies.

NEW YORK, N. Y.—The Alek Manufacturing company, to manufacture automatic musical instruments and electrical novelties, has been incorporated. Capital, $10,000. Directors, Emile Klaber, Jacob Greenberg and Eugene F. Crowe, of New York city.

NEWPORT NEWS, VA.—O. P. Loomis, of Bound Brook, N. J., builder of dynamos, motors and other electrical appliances, will transfer his business to Newport News. A $50,000 stock company is to be formed and a new factory building, 100 x 60 feet, which will give employment to 100 men, will be erected.

HAGERSTOWN, MD.—A factory for the manufacture of electric motors for the propulsion of bicycles and other machines is being erected on the Ragan property. Mr. Lewis Painton is inventor of the motor, which is intended as a substitute for foot power in bicycling, etc.

Business Troubles.

DORCHESTER, MASS.—The Cartwright Electric Company, consisting of J. Sheldon Cartwright, of Winthrop, and D. C. Cartwright, of Dorchester, has filed a petition in insolvency.

PEERLESS
COMMUTATOR COMPOUND.

AGENTS:
FOR NEW ENGLAND—W. B. Southgate & Co., 146 Franklin street, Boston, Mass.
FOR THE MIDDLE STATES—Bradford Belting Co., Cincinnati, O.
FOR THE PACIFIC COAST—Reyer & Atwater, San Franc'sco, Cal.
TEXAS—W. T. M. Mottram, Dallas.
DETROIT, MICH.—Commercial Electric Engineering Co.
LONDON, ENG.—Robert W. Blackwell.

A. CHISHOLM & CO.,
BAY CITY, MICHIGAN.

Use the brush that gives the best results at least cost.

EXCELSIOR BRUSH.

Cheapest brush on the market, quality considered. Made of special tempered copper. Write for prices.
NICHOLAS ZOCC,
732 East 143d Street, N. Y. CITY.

ROYCE & MAREAN,
DEALERS IN
Electrical Supplies,
WASHINGTON, D. C.

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

AGENCIES:
ELECTRIC APPLIANCE CO., CHICAGO, ILL.
PETTINGELL-ANDREWS CO., BOSTON, MASS.
ELECTRICAL ENGINEERING CO. MINNEAPOLIS, MINN.
ST. LOUIS ELECT'L SUPPLY CO., ST. LOUIS, MO.
BRADFORD BELTING CO., CINCINNATI, O.

PHILLIPS INSULATED WIRE CO.,
NEW YORK OFFICE: 39 & 41 Cortlandt Street.
FACTORY: PAWTUCKET, R. I.

FIRE.

The destruction of our Works by fire on April 7th was almost complete.
We have already resumed manufacturing and are making limited shipments, which are daily increasing.
Send us your orders. We will fill them with reasonable despatch, or advise you promptly if we cannot.

CROCKER-WHEELER ELECTRIC COMPANY,
Manufacturers and Electrical Engineers.
New York. Chicago. Boston. Philadelphia.
Sizes up to 250 H. P.

ELECTRICAL PATENTS

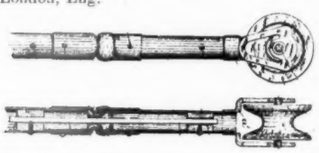
ISSUED AUGUST 20, 1895.

544,647 Automatic electrical railway signal; C. B. Alsop, Middletown, Conn.

544,654 Plant for generating electricity; G. R. Bowen, San Antonio, Texas.

544,688 Apparatus for electroplating; F. Englehard, Springfield, Mass. — A tank, hanger supports thereon, hangers horizontally adjustable on said supports, shafts vertically adjustable on said hangers, electrodes carried by said shafts, and means for simultaneously rotating the electrode supports.

544,673 Secondary battery; F. King, London, Eng.



No. 544,677.—TROLLEY ARM AND ATTACHMENT.

544,677 Trolley arm and attachment therefor; G. Maag, Newark, N. J.—An arm composed of tubular sections, a flexible joint connecting said sections, a flexible rod in said sections, and means for securing said rod in position in said sections.

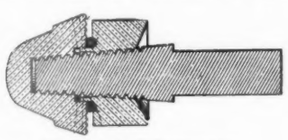
544,685 Electric locomotive; E. H. Porter, Radford, Va.—Has an electric motor with two armatures having connecting rods joining the main connecting rods and the armature cranks.

544,696 Dynamo-metric governor; W. N. Smith, Chicago, Ill.

544,711 Telephone switch and system; E. C. Wilcox, Meriden, Conn.

544,745 Electrically controlled weighing apparatus; L. H. Nutting, Davenport, Iowa.—Has a weighing hopper and electrically operated means for elevating the hopper rods to open the doors of the hopper.

544,747 Manhole for electric cable or other subways; E. L. Ransome, Chicago, Ill.—A manhole chamber having electric conductors passing around the wall thereof;



No. 544,778.—INSULATOR.

a circular shield for protecting said conductors and devices for raising said shield so as to permit of access to said conductors.

544,749 Electric motor; B. P. Remy, Peru, Ind.

544,768 Electric elevator; N. O. Lindstrom, Union Course, N. Y.—Comprises a car, a driving electric motor, a circuit controller for reversing the motor circuits, and a switch on the car and connections for normally maintaining the motor field magnet charged.

544,774 Automatic safety trolley; J. B. Scranton, New Haven, Conn.—A trolley arm, a finder pivotally attached to the head of said trolley arm and held in position by yielding connections with said head above and below said finder.

544,778 Insulator for electric or other wires; C. Sproat, Taunton, Mass.—A base, a cup or head provided with a series of annular concentric corrugations and means whereby said head or cup may be pressed down upon a wire lying on said base.

544,780 Electric elevator; J. C. Winters, Mount Morris, N. Y.

544,781 Electric switch; T. H. Brady, New Britain, Conn.—An electric switch having jaws of a rigid character and also a separate spring frame and spring adjacent to the frame of said jaws with its spring bearing upon one of the jaws and forcing it to its work.

544,794 Trolley arm and wire finder; F. W. Riess, Philadelphia, Pa.

544,802 Railway signal; W. B. Vansize, New York, N. Y.

544,844 Carbon brush-holder for dynamo electric machines; A. B. Churchward, Brooklyn, N. Y. — A frame adapted to receive the brushes, plates attached to each of the brushes, connecting rods secured to the plates, springs surrounding the said conductors, means for adjusting the tension of the said springs, and a conductor connecting the conductor rod.

544,847 Apparatus for insulating electrical conductors; L. W. Downes, Providence, R. I.

544,861 Applying power at a distance by means of electricity; J. F. McLaughlin, Philadelphia, Pa.—A mechanical power-controlling device and an electric motor for actuating the same; a coupling between the two, automatically connecting and disconnecting the same, and timed to engage the latter after the former has started without load.

544,862 544,863 Electric railway; J. F. McLaughlin, Philadelphia, Pa.

No. 544,959.—INSULATOR.

544,876 Ships' telegraphic apparatus; J. K. Adelsberg, Liverpool, Eng.—Two indicators having the words "Ahead" and "Astern" with suitable electrical connections.

544,890 Magneto-electrical telephone; M. Frank, Munich, Germany. — A magnetic core and surrounding magnetic shell magnetically connected, a diaphragm magnetically connected with the said shell and the diaphragm armature or core extending into a recess within the said magnetic core.

544,901 Telephone exchange apparatus; J. J. O'Connell, Chicago, Ill.

544,937 Electric train signal; F. C. von Sternberg, Brooklyn, N. Y.

544,959 Insulator; R. G. Collins and F. W. Foley, Dollar Bay, Mich.—A support, a sheath with a tortuous groove or slot for the reception of a wire.

545,005 Multiple electric circuit and mechanism for maintaining same; T. K. Ames, Peterborough, N. H.

545,009 Trolley; G. W. Biddell, Chattanooga, Tenn.—A trolley which permits the wheel to partially rotate or yield laterally through the medium of a block at the head provided with a stop shoulder.

545,020 Electrically controlled winding mechanism for time-locks. 545,021 Electric winder for time-locks; W. H. Hollar, Philadelphia, Pa.

EXPERIMENTAL WORK.

Metropolitan Chandelier and Electric Supply Works,

HUDSON & 12th STS., HOBOKEN, N. J.

Arc Light Repairing.

TELEPHONES AND SUPPLIES.

We are sole manufacturers of the celebrated KEYSTONE LONG-DISTANCE TELEPHONE, an instrument which has no superior. Write to us for Catalogue and prices.

KEYSTONE TELEPHONE CO., PITTSBURGH, PA.

WANTED—SPECIALTY.

A business concern of 20 years' standing, situated in the machinery district in Boston, Mass., having more floor space than required for their special use, desires some additional specialty, on commission, or will allow room for displaying and storing machinery, with agents' quarters and our good will. Everything convenient. For particulars, address BUSINESS, P. O. Box 2116, Boston, Mass., stating nature of business, etc.

PATENTS.

TRADE MARKS.—DESIGNS.—COPYRIGHTS.

CAN YOU OBTAIN A PATENT?

Send me a model or drawing of your invention, and a description, and I will examine same and advise you promptly. My fees are moderate in all Patent matters, and I can obtain a Patent in the shortest possible time.

All Patents taken out through me are given special notice in the leading journals of the country, thus bringing same widely before the public without cost to inventor.

REFERENCES: D. N. Morgan, U. S. Treasurer; John Goode, ex Solicitor Gen'l U. S.; Capt. L. G. Parker, U. S. Army; A. B. Duvall, Dist. Attorney for District of Columbia.

EDW. S. DUVALL, JR., Solicitor of Patents, Loan and Trust Bldg., WASHINGTON, D. C.

PATENTS

ROBT. H. READ,

SUCCESSOR TO

POPE, READ & ROGERS,

41 CORTLANDT ST., NEW YORK CITY.

Electrical Inventions a Specialty.

DYER & DRISCOLL,

Patent Solicitors, 36 Wall Street, N. Y.

have done all my patent soliciting work, both for this and foreign countries, continously for the past fourteen years.

Thomas A. Edison

FORÉE BAIN,

ELECTRICAL AND MECHANICAL ENGINEER,

SUITE 1657, 1658 AND 1659

MONADNOCK BLDG., CHICAGO.

MOTHER OF PEARL

Made into any design for Electrical Trimmings, Push Buttons, Knobs, Handles, etc. Can be made to cost no more than other material.

HENRY CHARLES EULER,

513 BROADWAY, NEW YORK.

CLEVELAND, OHIO, August 21, 1895.

NOTICE—Sealed proposals will be received at the office of the clerk of the Board of Control, No. 105 City Hall, Cleveland, Ohio, until 12 o'clock M., August 31, 1895, for furnishing and putting up in place 20 police boxes, fitted ready for telephones; also one 4-circuit desk or switchboard, with all the necessary devices to be used in connection with the above boxes; also one 8 inch gong indicator for the patrol station, No. 5, on Swiss street; all the above to be furnished and set up ready for the main lines, together with the necessary batteries.

Each proposal must contain the full name of the party or parties making the same, and all persons interested therein, and must be accompanied by a bond of two thousand ($2,000) dollars of some disinterested person or persons, resident of Cuyahoga County, or a certified check on a solvent bank in the city, as surety that if the proposal be accepted a contract will be entered into.

The city reserves the right to reject any or all bids. E. A. ABBOTT,
Director of Police.

THE LEHIGH VALLEY

CREOSOTING CO.

WORKS, PERTH AMBOY, N. J.

Office, Rooms 136 and 137, 1 Broadway, NEW YORK.

Creosoted Lumber, Underground Conduits. Telegraph Poles, Piling and Ties Furnished.

McINTIRE'S

PATENT CONNECTORS AND TERMINALS

FOR ALL ELECTRICAL PURPOSES.

THE C. McINTIRE CO.,

12-14 Franklin St., Newark, N. J.

W. R. OSTRANDER & CO.

No. 204 FULTON ST., NEW YORK.

Manufacturers of

SPEAKING TUBES, WHISTLES, ANNUNCIATORS.

Electric and Mechanical Bells.

FACTORY,

De Kalb Ave., BROOKLYN.

Send for Illustrated Catalogue.

IRON-CLAD RHEOSTATS,

MANUFACTURED BY

Geo. L. Colgate Company,

136 LIBERTY STREET, NEW YORK.

ESTABLISHED 1867

PARTRICK & CARTER CO.

ELECTRICAL SUPPLIES

125 South 2d St. Philadelphia

CATALOGUES ON APPLICATION

Send Business Card and Mention ELECTRICAL REVIEW.

PRIMARY BATTERIES.

OVER 5 VOLTS-5 AMPERES FROM 1 CELL

BOYNTON MULTIVOLT BATTERY CO., 10, 12 and 14 Whipple Street, BROOKLYN, N. Y.

ONE SOLUTION.

Size, 6 x 8 in.

Price, $6.50.

Send for Sample.

FARADAY CARBON CO.,

ELECTRIC LIGHT CARBONS,

JEANNETTE, PA.